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AND

MAGAZINE OF NATURAL HISTORY.

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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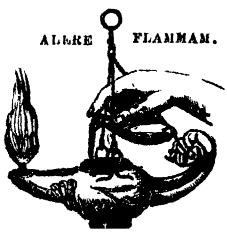
"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

"................ per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

No. 109. JANUARY 1927.

I.—*New* Dolichopodidæ *from the Ethiopian Region*.

By C. H. CURRAN, Entomological Branch, Ottawa, Canada.

THE species described in the following pages represent the new forms contained in a small collection of Dolichopodidæ received by Dr. Guy A. K. Marshall, of the Imperial Bureau of Entomology. The types of all the new species are deposited in the British Museum (Natural History).

In the Chrysosomatinæ there are still many described species which it is impossible to place in their proper genera, and a study of the types will be necessary before they can be properly identified. In presenting keys to the species of the various genera I have included only those species which are before me at the present time, and in some cases have included females which have not as yet been associated with males. These may or may not represent undescribed species, as this sex often differs greatly from the males and only series of specimens of both taken together will establish their correct relationship.

Genus CHRYSOSOMA, Guérin.

The males of this genus are usually readily recognized by means of structural characters, but the females are often extremely difficult to separate and associate with the opposite sex. The table which

follows will separate the African species represented in the collection on hand. In determining the colour of the squamal cilia it is necessary to view them from the tips of the hairs, as reflected light sometimes causes blackish hairs to appear yellowish.

Key to Species.

1. Pleura largely or wholly yellowish	2.
Pleura wholly or almost wholly dark in ground-colour	3.
2. Third antennal segment black or brown	*gemmarium*, Walk.
Antennæ wholly reddish	*kamerunense*, Beck.
3. Cilia of the squamæ whitish or yellowish	4.
Cilia of the squamæ black or brown..................	11.
4. Apical segment of the middle tarsi densely white-haired above	5.
Middle tarsi wholly black-haired	8.
5. First segment of the middle tarsi with three to six long fine bristles above	6.
Middle tarsi without long fine bristles above	7.
6. First segment of the middle tarsi with three long bristles above, with sub-basal and preapical broad white bands; anterior tarsi mostly black (S. Africa)	*flexum*, Loew.
First segment of middle tarsi with five or six long bristles above, wholly yellowish; front tarsi yellowish, becoming blackish apically (Nigeria)	*mixtum*, sp. n.
7. Fourth segment of middle tarsi white, the fifth whitish yellow, the second and third black; posterior tibiæ with sub-basal cicatrix (Zanzibar)	*snelli*, sp. n.
Third and fourth segments of the middle tarsi black; hind tibiæ without cicatrix-like area (Nigeria)	*pomeroyi*, sp. n.
8. Front coxæ wholly black in ground-colour or only narrowly reddish apically (Congo)	*katangense*, Curr.
Front coxæ more than half yellow......................	9.
9. Antennæ yellowish; front coxæ wholly yellow (Nigeria)	*vagator*, Beck.
Antennæ (except sometimes the base of the third segment) black; front coxæ very broadly black basally (Zanzibar)	10.
10. Wings wholly hyaline; front femora with two long coarse bristles on basal third below (♀) ..	*snelli*, sp. n.
Wings with conspicuous blackish markings on the apical half; femora without unusual bristles (Nigeria, Zanzibar) (♀)	Sp. (?).
11. Anterior femora with at least the apical third reddish	12.
Anterior femora with at most the apex reddish ...	19.
12. Anterior femora wholly reddish yellow	13.
Anterior femora broadly black basally..............	16.
13. Thorax rather dull green with two broad, sub-lateral, purplish-bronze vittæ (Congo, Uganda)	*varivittatum*, Curr.
Thorax violaceous or lacking such vittæ	14.
14. Wings wholly hyaline (♀, Gold Coast)	Sp. (?).
Wings with brown markings	15.
15. Arista of the male antenna ending in a large elongate lamella (Congo)	*bequaerti*, Curr.

Arista simple; wings brown with the base, posterior border, and an interrupted median fascia hyaline or yellowish tinged (West Africa)	*albilimbatus*, Bigot.
16. Middle tarsi evenly ciliate on their whole length, the apical segment not white pilose above; more than half of the anterior femora black	17.
First segment of the middle tarsi with five or six very long, slender, black bristles in addition to about twice as many shorter ones; their colour pale yellowish, the apical segment with white pile above	18.
17. First segment of the anterior tarsi a little widened and densely white pubescent beneath; apical third of the first and whole of the following segment of the front tarsi on the postero-ventral edge with a row of downwardly directed, inwardly curved, white hairs, the second segment almost two-thirds as long as the first (Congo)	*albocrinitatum*, Curr.
Anterior tarsi simple, the second segment only about one-third as long as the first (Congo) ...	*consentium*, Curr.
18. First segment of the middle tarsi with a very broad, pre-apical, white band (Sierra Leone) ...	*hargreavesi*, sp. n.
First segment of the middle tarsi wholly yellowish, except the slightly browned tip (Tropical Africa)	*senegalense*, Macq.
19. Anterior tibiæ black or brown	20.
Anterior tibiæ yellowish, the middle pair of praccally the same colour (South Africa)	*munroi*, Curran.
20. Knobs of the halteres yellow (South Africa)	*ernestum*, Curran.
Knobs of halteres blackish (South Africa)	*auratum*, Curran.

Chrysosoma mixtum, sp. n. (Fig. 1.)

Rather dull metallic green, the mesonotum and abdomen with some bluish reflections; wings coloured very much as in *senegalense*, Macq., but more extensively brown than is usual in that species.

Length 7·5 mm.

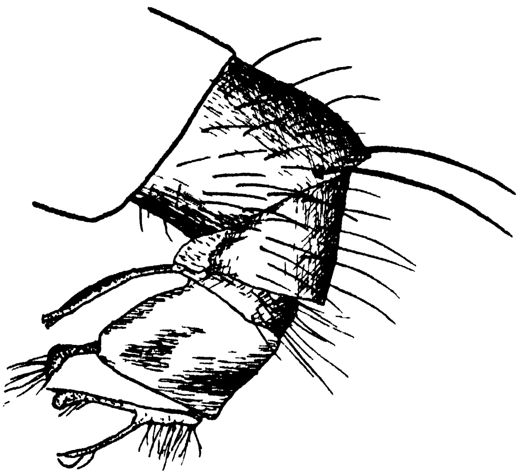
Male.—Face above almost as wide as eye, rather strongly narrowed below, the upper and lower sections gently convex in profile, the lower section moderately whitish pubescent. Front wide, bare except for a single orbital bristle and the ocellars. The black orbital cilia are short and are limited to the upper fourth of the eye; occipital pile abundant, with yellowish tinge. Proboscis and palpi reddish, the latter with two black bristles and pale yellowish hair. Antennæ black, the third segment small, triangular, the black terminal arista as long as the head and thorax together.

Thorax more or less bluish or violaceous in the middle, without evident pollen above, the pleura with rather thin cinereous pollen. Propleural pile white. Four pairs of strong acrostichal bristles; two strong dorso-centrals behind and about seven pairs of short fine hairs in front of them; scutellum with only two bristles.

Coxæ green, grey pollinose, each with two black bristles towards the apex, the posterior pair with pale pile and one black bristle exteriorly. Legs reddish yellow, the tarsi brownish apically, the anterior femora black on almost the basal half, the middle pair on

less than the basal half, the posterior pair black except on the broad apex, the posterior tarsi wholly brown. Anterior femora with a row of long white cilia antero-ventrally decreasing in length apically, and with long white hair behind, their tibiæ with three small weak bristles; first segment of the anterior tarsi hardly three-fourths as long as their tibiæ, but longer than the remaining segments, beset postero-ventrally with a row of abundant, short, very fine, apically curved hairs, most of which are about as long as the thickness of the tarsus. Middle femora with a row of long, black, postero-ventral cilia and a row of much weaker, shorter, antero-ventral hairs, of which a few of the basal ones are pale, their tibiæ with a row of eight or nine long, fine, dorsal bristles, which continues along the whole of the first tarsal segment to the number of five and on this organ one or two short fine bristles lie

Fig. 1.



Chrysosoma mixtum, sp. n. Lateral view of ♂ genitalia.

between them; the third and fourth segments of the middle tarsi each bear a dorsal row of fairly long, coarse, black hairs which decrease in length basally, whilst the fifth segment is clothed above with dense white hair. Posterior femora with an antero-ventral row of fine short cilia, those on the apical half much shorter than the width of the femur, but increasing in width towards the base, where they are once and one-half as long as the width of the femur; posterior tibiæ and tarsi simple.

Wings yellowish brownish, with the wide posterior border cinereous hyaline, and an indefinite pale spot in front beyond the tip of the first vein, the middle of the cells also paler in colour. Border of the squamæ brown, the cilia pale yellowish. Halteres brownish luteous. Wing-venation almost as in *senegalense*, Macq.

Abdomen with the narrow apices of the segments dull black, the genitalia brownish black, the outer lamellæ luteous. Hair of the abdomen sparse, long, shorter dorsally, pale on the sides and venter towards the base, elsewhere black. Bristles long. (Genitalia as in fig. 1.)

Type, ♂, Ibadan, Nigeria, 20. iii. 1923 (*A. W. J. Pomeroy*). Paratype, ♂, Iseyin, Southern Nigeria, 9. x. 1920 (*Pomeroy*).

The paratype is in the author's collection.

Chrysosoma snelli, sp. n. (Figs. 2, 3, & 4.)

Wings wholly hyaline; metallic green, the apices of the abdominal segments dull black; fourth segment of the middle tarsi white, with crest of silvery-white hair.

Length 5·5 to 6·25 mm.

Male.—Head bright green, the face above about as wide as one eye, one-third narrower below, the front very wide; face moderately white pruinose, the upper section strongly, the lower section weakly convex in profile; frontal orbits with several fine white hairs above, without bristles except at the vertex and on ocellar swelling. Occipital cilia black, very short and fine, limited to the upper fourth of the eyes; beard abundant, white. Palpi and proboscis yellow, the former with two black bristles and silvery-white hairs. Antennæ black, the third segment triangular, acute, not quite as wide as the second segment, the arista slender, one-fourth longer than the head and thorax; second antennal segment with rather short bristly hairs.

Mesonotum practically without pollen except on the humeri and notopleura, which, together with the pleura, are white pollinose, with slight bluish reflections in some lights. Three pairs of strong acrostichal bristles, two pairs of strong dorso-centrals behind and several fine hairs in front of them; scutellum with two pairs of bristles, the basal pair weak; propleural hair white.

Coxæ black, greyish pollinose, white-haired, without black bristles; femora black, the apical fourth of the front and apex of the middle pair reddish; tibiæ yellowish, the apices of the posterior four brown, the posterior pair broadly black sub-basally; posterior tarsi wholly, anterior tarsi except the first segment, tip of the first and fifth and whole of the second and third segments of the middle pair black or brown, the fourth segment of the middle pair white and silvery-white pilose, the fifth yellowish with silvery hair, the first segment with the subapical fourth rather swollen and whitish. All the femora bear long whitish hair below, the anterior pair in addition with two long, strong, pale yellowish bristles on the basal fourth and three much finer, shorter ones on the median half, their tibiæ with three fairly strong dorsal bristles. First segment of the anterior tarsi scarcely as long as their tibiæ, with two weak, short, dorsal bristles before the middle, their lower surface posteriorly with very short, dense, pubescence-like hair forming a soft cushion, the remaining simple, together a

little over two-thirds as long as the first segment. Middle tibiæ with two dorsal bristles, one near the base the other near the middle, the length of the tibiæ almost one-third greater than that of their femora, the first tarsal segment somewhat shorter than the tibiæ, beset on the antero-ventral edge with a row of bristles which are about as long as the width of the tarsus and curved and considerably broadened beyond their middle, the second segment with noticeably long hair antero-ventrally, the white hair on the two

Fig. 2.

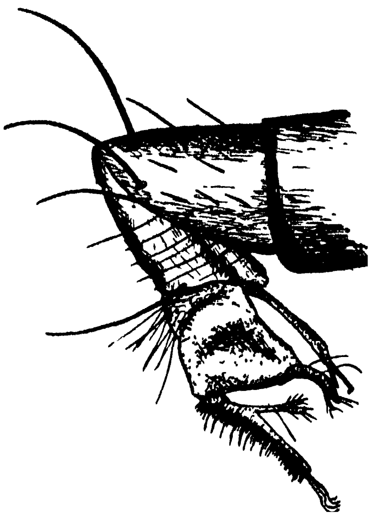


Fig. 4.

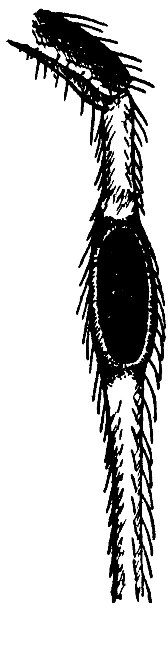


Fig. 3.

Chrysosoma snelli, sp. n.

Fig. 2.—Lateral view of ♂ genitalia.
Fig. 3.—Lateral view of middle tarsus of ♂.
Fig. 4.—Base of posterior tibia of ♂, posterior surface.

apical segments forming a dense crest. The posterior tibiæ are strongly broadened sub-basally, where there is an elongate-oval black cicatrix on the inner side, the outer or anterior side of the swelling smooth, the posterior legs otherwise simple. The hair of the legs is black, rather conspicuous on the tibiæ and tarsi.

Wings hyaline; posterior cross-vein with two strong curves (∼-shaped). Squamæ white, the rim black, the cilia white. Halteres pale yellowish.

Abdomen with some bluish reflections laterally towards the base, conspicuously greyish pollinose in most views, the apices of the segments dull black; first segment, second except in the middle, lateral borders of the remainder and the venter, with white hair, the bristles long and fairly slender. Genitalia (fig. 2) black, the large branch of the outer lamellæ brownish luteous; the hair of the genitalia mostly pale.

Female.—Five pairs of strong dorso-central bristles; a little more than half of the anterior pair of coxæ reddish, at their apex with two yellow bristles. Anterior femora with long yellow bristles as in the ♂, the hair sparse, shorter, yellow; front tibiæ with the bristles (except the basal pair) long, the first segment of their tarsi with a long bristle above beyond the middle. Middle femora with a row of fairly long yellow cilia below, the hair sparse, their tibiæ with a long antero-dorsal bristle at the basal fifth and another at the middle, a short antero-dorsal bristle at the apical third, a short ventral one at the apical fourth, and a fairly long sub-basal one below; posterior tibiæ with strong antero-dorsal bristle at basal fifth and a weaker dorsal one at the apical third. The legs reddish yellow; the apex of the posterior femora, apical third of their tibiæ, and the whole of their tarsi black; the anterior four tarsi black from the apex of the first segment; the legs simple.

Type, ♂, and two paratypes, Pemba Island, Zanzibar, 15–23. ix. 1924; allotype, ♀, and two ♂ paratypes, near Mazi Moja, Zanzibar, 20. viii.–11. ix. 1924 (*H. J. Snell*).

Chrysosoma pomeroyi, sp. n. (Fig. 5.)

Metallic green with faint bluish reflections dorsally; apical four segments of the middle tarsi with a dorsal crest of white hair; wings with weaker brownish markings than in *senegalense*, Macq. Antennæ reddish.

Length 7·5 mm.

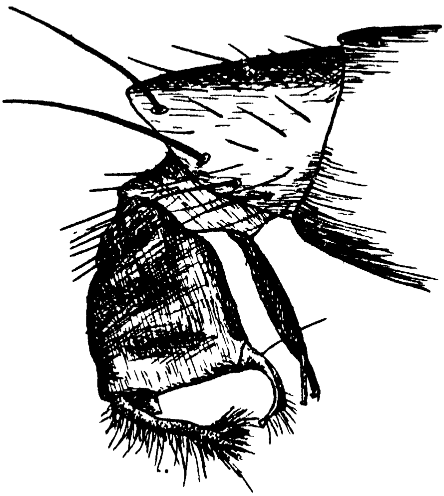
Male.—Face not as wide as eye, conspicuously narrowed below, the front wide, with a single yellowish orbital hair above; face white pollinose below the lower fourth of the moderately convex upper section, the lower section scarcely convex. Occipital cilia black, very short, limited to the upper fourth of the eye; beard white, not dense. Proboscis and palpi reddish, the latter with two black bristles and short white hairs. Antennæ red, the third segment on the apical third and the arista, black, the third segment not longer than wide, subtriangular, convex below, the arista shorter than the head and thorax.

Mesonotum somewhat violaceous in the middle, practically without pollen, the pleura whitish pollinose. Three pairs of strong acrostichals, two pairs of strong dorso-centrals behind, and three or four pairs of fine hairs in front of them; one pair of scutellars; propleural hair white.

Coxæ black, greyish-white pollinose, white pilose, the anterior pair with two black bristles apically; trochanters, tips of middle

and hind tibiæ, posterior tarsi, apices of the first three and whole of the apical two segments of the middle tarsi, and the anterior tarsi beyond the apex of the first segment brown, the legs elsewhere reddish yellow. Anterior femora with a row of long yellowish cilia on each lower edge, the bristles decreasing in length apically, and there are long yellowish hairs behind; middle femora with a postero-ventral row of somewhat shorter cilia, the posterior pair on the basal half or less of the antero-ventral surface with a still shorter row of yellow cilia and on the basal third with an anterior row of longer ones situated above the middle. Anterior tibiæ with three short dorsal bristles on the basal half, the middle tibiæ with four anterior bristles, one antero-dorsal near the base

Fig. 5.



Chrysosoma pomeroyi, sp. n. Lateral view of ♂ genitalia.

and two postero-dorsal bristles; posterior tibiæ with eight dorsal, five ventral, and four anterior bristles. First segment of the anterior tarsi four-fifths as long as the tibia, on the postero-ventral edge with moderately long, fine, curved, ciliate hairs, the remaining segments with dense white pubescence beneath. First and second segments of the middle tarsi very pale, the former with several short black bristles on either edge of the lower surface, the second to fourth with two rows of squamose silvery-white hairs dorsally, the fifth very densely clothed above with appressed white hair. Posterior tarsi simple.

Wings with the veins broadly clouded with pale yellowish brown, appearing pale brown in front (the colour is probably quite brown

in fully mature specimens), the posterior cross-vein ⁓-shaped. Cilia of the two squamæ pale yellowish; halteres luteous.

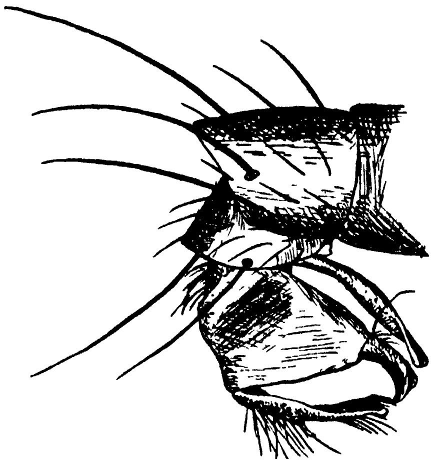
Abdomen appearing silvery-grey pollinose in some views, the sides broadly bronzed; venter and genitalia black. Hair black, short dorsally; white on the first segment, sides of the following two, and basal half of the venter. Genital hairs wholly black.

Described from a single ♂, Ibadan, Southern Nigeria, 1. ix. 1920 (*A. W. J. Pomeroy*).

Chrysosoma hargreavesi, sp. n. (Fig. 6.)

Very similar to *senegalense*, Macq., but the first segment of the middle tarsi bears a whitish band before the apex, and to *flexum*,

Fig. 6.



Chrysosoma hargreavesi, sp. n. Lateral view of ♂ genitalia.

Loew, but there are five long dorsal bristles on this segment above; the genitalia differ from those of both the species mentioned.

Length 7·5 mm.

Male.—Rather dull metallic green, the sides of the abdomen bronzed, the apices of the segments narrowly dull black. Face hardly as wide as eye, rather strongly narrowed below, in profile the upper section moderately, the lower section but little, convex; front wide, with one black orbital bristle above. Occipital cilia very short, black, limited to the upper fourth of the eye; beard white, fairly thick. Proboscis and palpi reddish, black basally, the latter with two black bristles and fine white hair. Antennæ black, the second segment with short black bristles, the third tri-

angular, somewhat longer than wide; arista slender, hardly as long as the head and mesonotum combined.

Mesonotum practically without pollen, the pleura greyish-white pollinose, the propleural pile white. Two pairs of strong dorsocentrals behind and four pairs of very fine hairs in front of them; three pairs of strong acrostichals; one pair of scutellars.

Coxæ black, greyish-white pollinose, white pilose; front pair with two black bristles towards the end. Anterior four femora on about the basal third, the posterior pair wholly, or almost wholly, black; posterior tarsi entirely, apices of the first to third and whole of the apical two segments of the middle tarsi, and the anterior ones from the apex of the first segment black; the legs elsewhere reddish yellow except for a very broad, preapical, white and narrower whitish basal band on the first segment of the middle tarsi. All the femora bear long, ciliate, bristly hairs below, these becoming obsolete apically and shorter on the posterior pair, those on the anterior femora mostly whitish, on the posterior four about half white. Front legs simple. Middle tibiæ with seven long, slender, dorsal bristles, the first segment of their tarsi with five and without the usual short white bristles between the long ones, but on their postero-ventral edge about ten short erect bristles; the coarse black hair on the third segment becomes rather long towards the apex, while on the fourth segment it is wholly fairly long, and on the fifth segment the hair is fine, appressed, white, very abundant, the sides of the fifth segment black-haired. Posterior legs simple.

Wings broadly brown in front and along all the veins, the cells somewhat paler, the costal brown band interrupted at the middle, the posterior border and base cinereous hyaline; venation as in *senegalense*, the posterior cross-vein ⁓-shaped. Squamal cilia blackish; halteres brown with paler base.

Abdomen in some views with brownish-yellow pollen, the sides broadly bronzed, the apices of the segments narrowly dull black. Hair black, short dorsally, long laterally and on the venter; pale on the first segment, sides of the second, and on the first two sternites.

Type, ♂, Bush, Sierra Leone, 12. ix. 1924 (*E. Hargreaves*). Paratypes: ♂, Rotifunk, 10. x. 1924, and ♂, Mosokobe, Sierra Leone, 27. ix. 1924 (*E. Hargreaves*).

The last-mentioned specimen is in the author's collection.

Genus Sciapus, Zeller.

Becker lists fourteen species as definitely belonging to this genus. To these must be added six others, two of which are herein described for the first time. *S. rosaceus*, Wied., was included by Becker in *Chrysosoma*, while *flavirostris*, Loew, was not assigned to any genus. The remaining two species have been described since the publication of Becker's paper*. In addition to these there are probably several other described species from the region,

* Ent. Mitt. xii. 1923.

but until the types are examined it will not be possible to be certain of their position. Eight of the species listed by Becker belong to the Palæarctic region. The species before me are separable by means of the following key:—

Table of Species.

1. Thorax and abdomen reddish yellow, the latter with narrow blackish segmental apices	*rosaceus*, Wied.
Thorax green or blue, at least dorsally	2.
2. Femora black; wings chiefly blackish (Uganda)	*subfascipennis*, Curr.
Femora yellow; wings without brown markings	3.
3. All the coxæ reddish	4.
Posterior four coxæ blackish	6.
4. Front wholly shining green; mesonotum without thick pollen except on the sides (S. Africa) ...	*bevisi*, sp. n.
Front normally pollinose at least in the middle and laterally; mesonotum rather thickly pollinose	5.
5. Front wholly whitish pollinose; ground-colour of the thorax not metallic; abdomen pale luteous, with black segmental apices; third antennal segment largely brown (Egypt)	*adumbratus*, Beck.
Front pollinose in the middle and laterally; ground-colour of the thorax metallic greenish; abdomen green, brownish red basally and ventrally	*palliatus*, sp. n.
6. Posterior femora of ♂ with a row of long black hairs below; ♂ ♀ with three pairs of strong acrostichals	*flavirostris*, Loew.
Posterior femora of ♂ not black ciliate below; acrostichals extremely weak or wanting	*trochanteralis*, Curr.

Sciapus bevisi, sp. n.

Metallic green, the abdomen thinly greyish pollinose laterally; antennæ and legs reddish.

Length 4 mm.

Female.—Face less than half as wide as eye, slightly narrowed below, thinly whitish pubescent; front moderately wide, shining green. Occipital cilia limited to the upper fourth of the eye, black; beard long, very pale yellowish. Palpi and proboscis reddish, the latter yellowish pollinose and pilose and bearing two fine black bristles. Antennæ reddish, the upper margin of the third segment obscurely brown; arista dorsal, brown.

Mesonotum brilliant green, somewhat bronzed, the sides and pleura whitish pollinose; acrostichals in two rows in front of the suture, fine, short; five pairs of dorso-centrals; propleural hair whitish.

Legs, including the coxæ, reddish yellow, the latter thinly whitish pollinose, short, pale yellowish pilose, the anterior pair with two yellow bristles apically; immediate tips of the tarsi somewhat darkened. The few bristles on the tibiæ very short and weak, the femora with inconspicuous pale hairs below, the legs elsewhere black-haired.

Wings hyaline; posterior cross-vein slightly oblique, gently

curved, situated at one-third its length from the margin of the wing. Cilia of the squamæ yellowish; halteres reddish yellow.

Abdomen bright green, the first segment laterally and the venter reddish; hair wholly short, sparse, yellowish.

Type, ♀, Umbilo, Durban, 12. x. 1919 (*A. L. Bevis*).

Sciapus palliatus, sp. n.

Very similar to *bevisi*, sp. n., but the front is broadly pollinose in the middle, the thorax greyish pollinose, etc.

Length 4·5–5 mm.

Female.—Face less than half as wide as eye, slightly widened above and below, the lower section wider than long, yellowish-grey pollinose. Front moderately narrow, the borders yellowish-grey pollinose, a broad median stripe similarly clothed, the bare part brilliant blue or violaceous. The black occipital cilia limited to the upper one-fifth or one-sixth of the eye; beard rather long, white. Proboscis and palpi yellow, the latter white pollinose, white-haired and bearing two slender, short, blackish bristles. Antennæ reddish yellow, the third segment sharply rounded in the middle of its apex, the arista brown except basally.

Pleura largely pale, dark below; mesonotum metallic green, the sides pale in front, rather densely yellowish-grey pollinose, the middle less densely so. Acrostichals scarcely evident; five pairs of dorso-centrals; propleural pile white.

Legs reddish yellow, the tarsi scarcely darkened apically; coxæ with thin whitish pollen, sparsely yellow pilose, the anterior pair with three yellow bristles on the apical third. Femora with inconspicuous pale hair below, the legs elsewhere black-haired, simple.

Wings hyaline or with weak yellowish tinge; posterior cross-vein strongly oblique, almost straight. Squamal cilia white; halteres pale yellow, the knob orange.

Abdomen shining brassy green, the bases of the segments rather narrowly violet-black, the first segment mostly brownish red, the narrow sides of the tergites and the venter reddish. Abdominal hair yellow, short; the short, fine, marginal bristles black.

Type, ♀, Umbilo, Durban, Natal, 4. x. 1914. Paratypes, 3 ♀ ♀, same locality, 4, 5. x. 1914 and 7. x. 1919 (*A. L. Bevis*).

The last-mentioned specimen in the author's collection.

Condylostylus stenurus, Loew.

Psilopus stenurus, Loew, Dipt. Sudafrikas, p. 274 (1860).
Condylostylus sicatrix, Curran, Ann. S. Afr. Mus. xxiii. p. 399 (1926).

I have not the slightest doubt about the above synonymy being correct. A careful comparison of one of the types of my species with Loew's description, which was not available at the time the species was described, convinces me that the two are the same.

Genus TENUOPUS, Curran.

This genus is apparently somewhat related to the Chrysosomatinæ, as in the species here described the thorax is not as long as usual and is therefore much wider in proportion to its length. There is a strong fold beyond the bend of the fourth longitudinal vein, but the fold is not connected with the vein. Those species which are known to belong to this genus are separable as follows :—

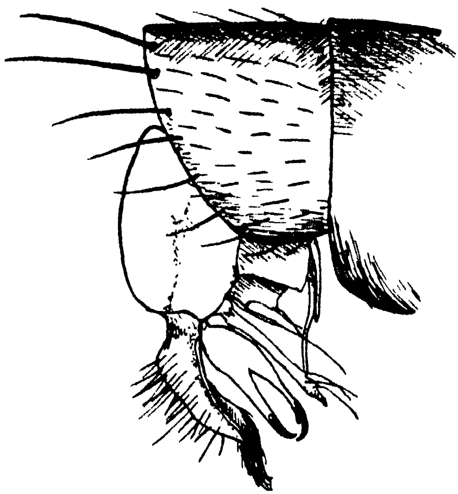
1.	Mesonotum wholly metallic green	*cyanescens*, Loew.
	Mesonotum rusty reddish yellow, with median green vitta	2.
2.	Acrostichal bristles weak, in a single row in front of the suture ; first sternite not black	*univittatus*, Loew.
	Acrostichal bristles in two rows, rather strong, reaching to the posterior third of the mesonotum ; first sternite black	*acrosticalis*, sp. n.

Tenuopus acrosticalis, sp. n. (Fig. 7.)

Resembles *univittatus*, Loew, but is readily distinguished by the pollinose front, the presence of two rows of strong acrostichal bristles, etc.

Length 8 mm.

Fig. 7.



Tenuopus acrosticalis, sp. n. Lateral view of ♂ genitalia.

Male.—Head thickly silvery-white pollinose, pale in ground-colour; front with only the strong ocellar bristles developed, but little hollowed. Occipital pile pale yellowish; occipital cilia black. Proboscis pale yellow; palpi whitish, fairly large,

with whitish hairs. Face and front narrow, the latter but little wider than the face. Antennæ yellow, the first segment white except dorsally, the second with black hairs apically; arista black, long, shortly pubescent, situated at the middle of the upper edge of the subquadrate third antennal segment.

Mesonotum rusty reddish yellow, the area between the dorso-central bristles metallic green, the whole thinly whitish pollinose, the scutellum green except the border; pleura pale yellowish, white pollinose. Five pairs of dorso-centrals and a strong bristle in front of the inner end of the posterior calli; three bristles above the anterior coxæ.

Legs pale reddish yellow, the tarsi blackish or brown with the bases somewhat paler. Anterior coxæ whitish, with coarse, short, black hairs and black bristles apically; posterior coxæ with a strong sub-basal black bristle on the outer surface and several tiny hairs near its base. Femora with fine ciliate hairs below, most of which are half as long as the width of the femur, the anterior pair with pale hair on the lower half posteriorly. Anterior tibiæ with four bristles, one antero-dorsal, near the base, the others postero-dorsal; the first segment of their tarsi slightly longer than the tibiæ, with two black bristles above. Middle tibiæ with three ventral, one anterior, three antero-dorsal, and three postero-dorsal bristles; first segment of the middle tarsi with one dorsal and several postero-ventral bristles. Posterior tibiæ with four postero-ventral, four postero-dorsal, and four antero-dorsal bristles; the first segment of their tarsi with one dorsal and several antero-ventral bristles. Middle and hind femora each with an anterior preapical bristle; hair of the legs all rather strong, especially on the tarsi.

Wings cinereous hyaline, with slight luteous tinge. Squamal cilia yellowish; halteres reddish yellow, with pale base.

Abdomen compressed, rusty reddish yellow, somewhat shining, the apex of each segment except the first narrowly black, the hair rather long and coarse, the bristles on the apices of the segments rather strong. Genitalia small (fig. 7).

Type, ♂, Kampala, Uganda, 10. xii. 1923 (*H. Hargreaves*).

Genus Medetera, Fischer.

Of this genus I have seen representatives of eleven species from Africa, while Becker lists six others, three from the Island of Tristan da Cunha, the remainder from the Palæarctic region. The following table will separate the species known to me:—

1.	Legs black (the tibiæ and tarsi may be brown); four dorso-central bristles, the anterior two rather short	10.
	At least the tibiæ reddish or yellowish	2.
2.	Lower section of the face wholly white or brown pollinose, the face and front similarly clothed, the ground-colour almost entirely hidden	3.
	Lower section of the face not wholly pollinose, at least the middle shining	6.

3. Three or four pairs of strong dorso-central bristles	4.
Only two strong pairs of dorso-central bristles and six or more short hair-like ones in a row in front of the suture (S. Africa)	*normalis*, Curr.
4. Three pairs of strong dorso-central bristles; head white; basal two antennal segments yellow; hair of abdomen short, sparse, white, subsquamose; two scutellar bristles (Egypt)	*albescens*, Parent.
Three or four pairs of strong dorso-centrals, if three the antennæ wholly black	5.
5. Three pairs of strong dorso-centrals; tibiæ and tarsi pale yellow, with yellow hair (S. Africa)	*caffer*, Curr.
Four pairs of equally strong dorso-centrals; tarsi blackish apically (Congo)	*maynei*, Curr.
6. Basal half of the anterior four femora black	7.
Anterior four femora wholly pale or but little darkened basally	8.
7. Thorax and sides of the abdomen metallic green, the former with grey and brownish pollen; abdomen bronze-coloured above	*nocturna*, sp. n.
Thorax and abdomen black, not metallic (S. Africa)	*predator*, Curr.
8. Pollen of the mesonotum rich brownish; propleural bristles clear white	9.
Pollen of mesonotum greyish, although the bronze ground-colour may impart a brownish tinge (S. Africa)	*penura*, Curr.
9. Face dark green, the pollen not dense (S. Africa) ...	*afra*, nom. nov.
Face densely brown pollinose (S. Africa)	*simplicis*, Curr.
10. Halteres and squamal cilia brown (S. Africa)	*munroi*, Curr.
Halteres yellow, the squamal cilia white (S. Africa)	*capensis*, Curr.

Medetera afra, nom. nov.

Medetera longitarsis, Curran, Ann. Transvaal Mus. x. p. 227, 1924 (nec de Meijere).

The use of this name for an Oriental species necessitates a change of name for the species described from Africa.

Medetera nocturna, sp. n.

Length 2·5 mm.

Face and front greyish-brown pollinose, the lower section bronze-green, more yellowish pollinose with the middle broadly bare. Occipital cilia black above and towards the mouth, elsewhere rather yellowish, the long sparse hairs of the occiput yellowish. Palpi and proboscis shining black, with black hairs. Antennæ brownish black.

Thorax metallic green, the colour partly obscured by greyish pollen which grades into brownish on the disc; a pair of bare median vittæ are evident on the anterior half of the mesonotum; dorso-centrals composed of two pairs of strong and one pair of weak bristles and a row of tiny hairs in front of them; acrostichal hairs fairly strong, in two well-separated rows. Scutellum rather bluish, greyish pollinose, with two bristles. A single rusty-brown propleural bristle.

Coxæ and the basal half of the femora black, the legs elsewhere

pale reddish yellow, their hair black, not conspicuous; basal segment of the posterior tarsi a little more than one-third the length of the second.

Wings pale cinereous hyaline, the veins luteous; posterior cross-vein once and one-third its length from the wing-margin; fourth vein ending in the tip of the wing, the third vein parallel with it apically. Squamæ and halteres yellow, the former with yellowish cilia.

Abdomen bronzed above, the sides metallic green, with rather thin whitish pollen. Venter black. Abdominal hair short, sparse, black.

Described from a single female, Tissana Bonth, Sierra Leone, 19. xi. 1924, at light (*E. Hargreaves*).

II.—*New or little-known* Tipulidæ (*Diptera*).—XXXIII. *Australasian Species*. By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

IN the present paper the writer has begun the consideration of the Australian and Tasmanian species of the genus *Molophilus*, a large and varied aggregation of small to medium-sized Eriopterine crane-flies. The group here attains its maximum of species, a condition that is scarcely approached in any other country, with the single exception of New Zealand. The numerous new species that are described at this time and in succeeding instalments under this title fall naturally into three large groups that are differentiated on characters of the male hypopygium. It should be noted in *Molophilus*, as well as several other genera of Tipulidæ, that the ninth segment of the abdomen of the male has undergone a torsion of 180°, so that the tergite occupies a ventral position. In the accompanying descriptions all characters and directions are *morphological* rather than *apparent*. The species described in this paper are mostly members of the *plagiatus* group, strongly developed in New Zealand as well as in Tasmania and Australia. Here the ventral lobe of the basistyle (fig. 1, *v*) of the male hypopygium is the only one preserved, produced caudad into a lobe of varying length, the mesal face before apex armed with a small chitinised beak.

The majority of the species of Australian *Molophilus* available for study at this time were collected in Tasmania, Victoria, and New South Wales by Dr. André Tonnoir, to

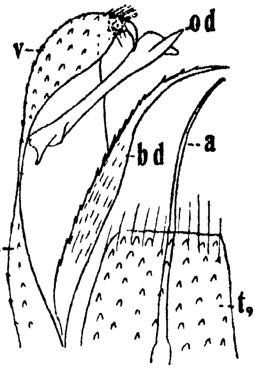


Fig. 1

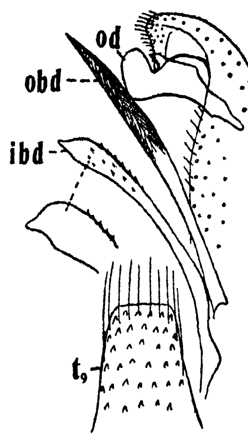


Fig. 2

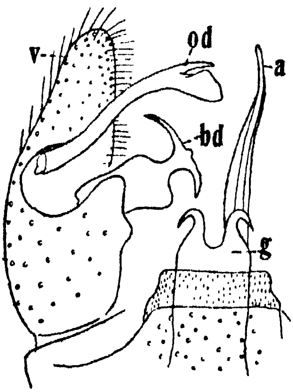


Fig. 3

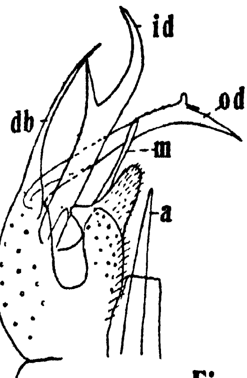


Fig. 4

Hypopygial details of the groups and subgroups of Australian; *Molophilus*.

Explanation of symbols :—*a*=ædeagus; *b*=basistyle; *d*=dististyle; *bd*=basal dististyle; *db*=dorsal lobe of basistyle; *g*=gonapophyses; *ibd*=inner basal dististyle; *m*=mesal lobe of basistyle; *obd*=outer basal dististyle; *od*=outer dististyle; *t*9=ninth tergite; *v*=ventral lobe of basistyle.

Fig. 1.—*Molophilus femoratus*, Skuse; the *plagiatus* group.
Fig. 2.—*M. pervagatus*, Skuse; the *pervagatus* group.
Fig. 3.—*M. ruficollis*, Skuse; the *gracilis* group, *ruficollis* subgroup.
Fig. 4.—*M. gracilis*, Skuse; the *gracilis* group, *gracilis* subgroup.

whom the types have been returned. I am vastly indebted to Dr. Tonnoir for the privilege of studying this splendid series of crane-flies. Additional species described in this paper were sent to me by Director Kershaw and Mr. Gerald F. Hill of the National Museum, Melbourne, and by Dr. Eustace W. Ferguson and Dr. Ian Mackerras of Sydney. I express my sincere thanks to the above-mentioned gentlemen for their co-operation in making known the vast Australian Tipulid fauna.

The accompanying notes on the conditions under which his collections were made were kindly supplied by Dr. Tonnoir, and give the locality, approximate altitude, time, and conditions under which the collections in question were made. These notes are given here in order to avoid repetition in succeeding parts:—

New South Wales:

Mt. Wilson, Blue Mts., 3475 ft., November; in gum and mixed bush in heavy soil of volcanic origin, different from Wentworth Falls.

Narara, 300 ft., November; collecting along creek in untouched subtropical bush.

Waterfall, 200–300 ft., November; 40 miles south of Sydney in National Park; in gum and mixed bush along creek, in sandstone country.

Wentworth Falls, Blue Mts., 2814 ft., November; collecting on shrubs along torrent in sandstone country.

Woy-woy, about 100 miles north of Sydney, sea-level, November; in mixed bush and shrub, rather dry sandy soil.

Victoria:

Fern Tree Gully, 500 ft., and *Sassafras*, 1000 ft., in the Dandenong Range, October; along creeks, through groves of tree-ferns, sassafras, and gums.

Tasmania:

Adventure Bay (south), sea-level to 50 ft., December; in gum and *Nothofagus* bush.

Burnie (north), 30–50 ft., late October and late January; along the Emu River in mixed bush, tree-ferns, sassafras, and gums.

Cradle Valley (north-west), 3500 ft., January; in alpine open land and pine forest.

Eaglehawk Neck, Tasman Peninsula (south-east), sea-level, November; in mixed bush and sand-hills vegetation.

Fern Tree, halfway up Mt. Wellington (south), November; along creek in gum-bush.

Geeveston (south), 100–200 ft., November, December; in heavy gum-bush.

Hartz Mts. (south), 3000 ft., early December; in alpine open land and shrub.

Hobart (south), 30–50 ft., early November, January; in gum-bush along creek.

King River (west), 500 ft., early February; in rain-forest, mostly *Nothofagus*.

Lake Margaret (west), 2500 ft., early February; in open alpine country, around lake.

Mt. Farrel (west), Mackintosh R., 1000 ft., early February; in rain-forest, mostly *Nothofagus*.

Mt. Field (centre), plateau, 3000–4000 ft., December; alpine open land.

Mt. Wellington (south), late November, early December; in gum-bush, second growth, and alpine open land.

National Park (centre), foot of Mt. Field, 1150 ft., December; in gum and sassafras bush along creek.

St. Patrick River (north), 1250 ft., late October, early November; in gum-bush along creek.

Strahan (west), sea-level, early February; in sand-hills vegetation and second-growth mixed bush along creek.

Wilmot (north), 200 ft., early January; along creek in second-growth bush.

Zeehan (west), 200–300 ft., early February; in second-growth mixed bush along creek.

Molophilus gemellus, sp. n.

Belongs to the *plagiatus* group, *annulipes* subgroup; head pale ochreous; mesonotal præscutum with three confluent brown stripes; pleura dark with a pale longitudinal stripe; femora with two narrow, ill-defined, brown annuli; wings yellowish subhyaline, longitudinally suffused with brown; male hypopygium with the outer dististyle only shallowly divided at tip; basal dististyle elongate, a little dilated near mid-length, the tip slender, sinuous, acute.

Male.—Length about 3·6 mm.; wing 5 mm.

Rostrum and palpi dark brown. Antennæ of moderate length, if bent backward extending about to the wing-root; basal segments pale, the distal half of the flagellum passing into brown; flagellar segments long-oval, with a conspicuous erect pale pubescence and a few scattered verticils. Head pale ochreous, a little darkened in front.

Pronotum obscure yellow. Lateral pretergites narrowly light yellow. Mesonotal præscutum with three confluent brown stripes, the median area a little cinereous, especially behind; humeral region conspicuously pale ochreous, the broad lateral margins of the præscutum brownish ochreous; pseudosutural foveæ elongate, blackish; scutal lobes brown, the median area more cinereous, the lateral margins narrowly brownish ochreous; scutellum and postnotum dark, pruinose with cinereous. Pleura dorsally dark brown, with a narrow paler longitudinal stripe extending from the halteres cephalad to just beneath the fore coxæ; sternopleurite and meron dark grey. Halteres pale, the knobs a trifle darker, with pale silken setæ. Legs with the fore coxæ darkened, the middle and posterior coxæ more testaceous; trochanters testaceous; femora brownish yellow with two narrow, ill-defined, pale brown annuli, arranged as in the *annulipes* subgroup, one ring post-medial, the other subapical, with a relatively wide pale ring between; tibiæ pale yellowish brown, the tips narrowly and weakly darkened; fore tibia (♂) with a narrow, dark brown, subbasal ring, tarsi pale brown, the terminal segments passing into darker. Wings yellowish subhyaline with longitudinal infuscations, including a broad conspicuous seam the entire length of Cu_1 and another narrower seam on R_5; bases of cells *Cu* and *1st A*, apex of cell *2nd A*, and tips of veins M_3 and M_4 clouded with pale brown; anal angle in cell *2nd A* darker brown; a small dark brown spot in cell *Sc* just beyond *h*, as in the subgroup; veins pale, darker in the infuscated areas; macrotrichiæ relatively sparse, of moderate length, pale brown. Venation: *r* about on a level with *r–m*; petiole of cell M_3 relatively short, the cell correspondingly deep; vein *2nd A* moderately long, extending to shortly beyond the cephalic end of the oblique *m–cu*.

Abdomen dark brown, the hypopygium somewhat paler. Male hypopygium with the basistyle divided into a long, slender, ventral lobe and a small, conical, darkened, dorsal lobe. Ventral lobe terminating in a slender black beak, directed strongly cephalad, this beak situated on a small fleshy lobe, surrounded by long setæ; dorsal lobe of basistyle with scattered setæ, narrowed to the apex. Outer dististyle long and slender, bifid at apex, the arms very small, one a narrow blackened cone in alignment with the axis of the style, the other longer, flattened, paler brown, the apex narrowly obtuse. Basal dististyle very long and slender, arising in the notch of the basistyle, the basal three-fourths yellow, the apical fourth blackened, narrowed into a sinuous acute

tip; the style near mid-length is dilated into a weak blade. Ædeagus very slender, a little more than three-fourths the length of the basal dististyle.

Hab. Tasmania.

Holotype, ♂, Burnie, October 25, 1922 (*A. Tonnoir*).

Molophilus gemellus is very different from the other members of the *annulipes* subgroup, although not closely allied to *M. flavonotatus*, Skuse (*canus*, Skuse), than to the species that centre about *annulipes* (*annulipes*, Skuse, *cingulipes*, sp. n., etc.).

Molophilus cingulipes, sp. n.

Belongs to the *plagiatus* group, *annulipes* subgroup; brown femoral rings narrow; male hypopygium with the teeth of the basal dististyle relatively small, grouped towards the apex of the style.

Male.—Length about 4 mm.; wing 5·6 mm.

Female.—Length about 4·5 mm.; wing 5·8–6 mm.

Rostrum brownish; palpi dark brown. Antennæ of moderate length, if bent backward extending to just beyond the wing-root; scapal segments yellow, the flagellum pale testaceous; flagellar segments long-oval, with conspicuous erect pale setæ. Head yellow.

Mesonotal præscutum pale reddish orange, the lateral margins and humeral region broadly pale, almost whitish; scutum broadly pale reddish orange, the lateral margins pale; scutellum pale yellow; postnotum reddish yellow. Pleura pale reddish yellow. Halteres pale, the knobs yellow. Legs with the coxæ and trochanters yellow; femora yellow with two narrow brown rings, one subterminal, the other some distance beyond mid-length of the segment, the yellow ring enclosed being more than twice the width of a single dark ring; tibiæ yellow, the fore tibiæ with the tips narrowly darkened; fore tibia (♂) with a narrow but conspicuous black subbasal ring; tarsi yellow, the terminal segments passing into brownish black. Wings with a strong pale yellow tinge, the stigmal region more saturated yellow; veins darker yellow; macrotrichiæ brownish yellow; a tiny spot in cell *Sc* beyond arculus. Venation: Vein *2nd A* bent strongly toward vein *1st A* near its tip, strongly narrowing cell *1st A*, the vein then bent strongly to the margin, ending just before the proximal end of *m–cu*.

Abdomen yellow, including the hypopygium. Male hypopygium of the general structure of *M. annulipes*, Skuse, differing conspicuously in the details of structure. Basistyle with the ventral lobe having the apex only slightly

produced, the beak larger. Basal dististyle with the teeth relatively small and grouped near the apex of the style, the more basal placed on the lateral face of the style at the base of the smaller of the two apical teeth. Ovipositor with the valves relatively long and slender, nearly straight.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 29, 1922 (*A. Tonnoir*).

Allotype, ♀, Fern Tree, Mt. Wellington, November 11, 1922 (*A. Tonnoir*).

Paratopotypes, 1 ♂, 4 ♀♀, November 26–29, 1922; *paratypes*, 1 ♂, 1 ♀, with the allotype (*A. Tonnoir*).

Molophilus persimilis, sp. n.

Belongs to the *plagiatus* group, *annulipes* subgroup.

Male.—Length about 3·6 mm.; wing 4·8 mm.

Female.—Length about 4 mm.; wing 5 mm.

Closely allied to *M. annulipes*, Skuse, and confused with it in collections.

Rostrum and palpi dark brown. Antennæ brown, the basal segments testaceous yellow. Head obscure yellow, more infuscated on the genæ.

Mesonotum light reddish brown, without distinct markings; pseudosutural foveæ pale; lateral margins of præscutum and median region of the scutum more pruinose. Halteres pale, the knobs yellow. Legs yellow, the femoral rings a little narrower than the yellow interspace; fore tibiæ (♂) with enlarged subbasal ring; tips of tibiæ and basal three tarsal segments narrowly infuscated; terminal tarsal segments uniformly dark brown. Wings strongly tinged with yellow; basal spot in cell *Sc* very conspicuous; veins yellow; macrotrichiæ pale brown, in the costal region light golden-yellow and more dense.

Male hypopygium with the apex of the ventral lobe of the basistyle somewhat conically produced, the very small beak thus being subapical in position, acute; dorsal lobe of basistyle terminating in a relatively long acute spine. Outer dististyle slender, sinuous, the longest arm extended into a long acute spine. Basal dististyle a long pale blade that terminates in two powerful spines, the outer a little longer and more slender, the tips of the spines directed slightly toward one another; a third powerful black spine on the lateral margin of the style at near two-thirds the length, the surface of the style at this point more infuscated and provided with two small setigerous punctures.

Hab. New South Wales.

Holotype, ♂, Blackheath, Blue Mts., altitude 3500 ft., April 15, 1922 (*E. W. Ferguson*); Collector's No. 67.

Allotopotype, ♀, January 21, 1922.

Paratopotype, ♂, January 21, 1922 (*E. W. Ferguson*); *paratypes*, 1 ♂, 1 ♀, Knapsack Gully, Blue Mts., removed from the type-series of *M. annulipes*, Skuse.

Type returned to Dr. Ferguson.

Molophilus parvistylus, sp. n.

Belongs to the *plagiatus* group, allied to *M. longicornis*, Skuse; antennæ of male elongate, nodulose; general coloration of mesonotum reddish brown, the pleura and postnotum dark brown, the former with a pale ventral longitudinal stripe; knobs of halteres dark; male hypopygium with the basal dististyle small, simple, narrowed gradually to the acute tip.

Male.—Length 4–4·5 mm.; wing 5·5–6 mm.

Female.—Length about 4 mm.; wing about 5·3 mm.

Rostrum and palpi dark brown. Antennæ dark brown, in the male only a little shorter than the body; flagellum nodulose (♂) and with conspicuous whorls of long white setulæ and sparse verticils. Head dark brown.

Pronotum dark brown. Mesonotum reddish brown to brown, the postnotum darker. Pleura dark brown with a broad ventral pleural pale stripe extending from the fore coxæ, passing just at the level of the halteres to the abdomen. In a few specimens the pleura is more uniformly darkened. Halteres dark, the extreme base of the stem pale. Legs with the coxæ and trochanters pale yellow; femora yellow, the colour obscured by rather conspicuous brown setæ; tibiæ and tarsi brown, passing into darker brown outwardly. Wings with a pale brown tinge, in some specimens with the cord and vein Cu_1 somewhat seamed with darker; veins and macrotrichiæ darker brown. Venation: *r* opposite or just beyond the level of *r–m*; vein *2nd A* ending opposite to just beyond the caudal end of the transverse *m–cu*.

Abdomen dark brown, including the hypopygium. Male hypopygium with the basistyles relatively short, the apex of the ventral lobe produced into a small to very small chitinized beak that is surrounded by numerous yellow setæ. Outer dististyle with the stem relatively stout, the arms of moderate length; outer arm triangularly expanded at apex, inner arm simple, more or less pointed at tip. Basal dististyle a very small, slender spine, narrowed gradually and subsinuously to the acute apex. Ovipositor with the valves yellowish horn-colour, slender, the tips acute.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 28, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotypes, 6 ♂♂, 1 ♀, November 26–December 1, 1922; *paratypes*, 2 ♂♂, Burnie, October 24–26, 1922; 1 ♀, January 31, 1923; 1 ♂, Mt. Field, December 18, 1922; 1 ♂, Eaglehawk Neck, Tasman Peninsula, November 14, 1922 (*A. Tonnoir*).

Molophilus duplex, sp. n.

Belongs to the *plagiatus* group, allied to *M. longicornis*, Skuse; antennæ of male longer than the body, strongly nodulose; mesonotum reddish brown, the pleura more yellowish; halteres dark; wings with a pale grey tinge; R_{4+5} much longer than the basal section of R_{2+3}; vein *2nd A* very short; male hypopygium with the basal dististyle bispinous.

Male.—Length about 3·2–3·4 mm.; wing 4·5–5·2 mm.

Female.—Length about 3·6 mm.; wing 4·7 mm.

Rostrum reddish brown, the palpi black. Antennæ (♂) nearly one-half longer than the body, dark brown throughout or the pedicels of the individual flagellar segments paler; flagellum very strongly nodulose, the segments with broadly oval basal swellings and slender glabrous apical pedicels that become longer on the outer segments, where they are one-half longer than the enlarged portion alone; swellings with conspicuous long erect setæ and sparse shorter verticils. In the ♀ the antennæ are short, not exceeding the wing-root. Head dark brown.

Mesonotum light reddish brown, the pleura a little more yellowish. Halteres dark, the base of the stem narrowly pale. Legs with the coxæ and trochanters yellowish testaceous; femora yellowish brown; remainder of legs brown, the terminal tarsal segments darker. Wings with a pale brown tinge, the veins darker, the macrotrichiæ dark brown. Venation: *r* lying far proximad of *r–m*; R_{4+5} long, from one and one-half to twice the basal section of R_{2+3}; vein *2nd A* very short, ending about one-third its own length before *m–cu*.

Abdomen dark brown, including the hypopygium. Male hypopygium with the apical beak of the basistyle moderately stout and chitinized. Outer dististyle large, the outer arm a flattened blade, the inner arm a straight spine. Basal dististyle short and flattened, beyond the short neck feebly

expanded into a blade, each outer angle of which is produced into a long, gently curved spine; disk of the style with a few small setiferous punctures. Ædeagus a little longer than the basal dististyle. Ovipositor with the valves relatively short but slender, gently upcurved, reddish horn-colour.

Hab. Tasmania.

Holotype, ♂, Eaglehawk Neck, Tasman Peninsula, November 22, 1922 (*A. Tonnoir*).

Allotopotype, ♀, November 14, 1922.

Paratopotypes, 2 ♂ ♂, November 15–17, 1922; *paratypes*, 1 ♀, Burnie, January 31, 1923; 2 ♂ ♂, St. Patrick's River, October 31–November 1, 1922; 3 ♂ ♂, Mt. Field, December 18–21, 1922; 1 ♂, 1 ♀, National Park, December 15, 1922; 4 ♂ ♂, Adventure Bay, December 30–31, 1922; 7 ♂ ♂, 2 ♀ ♀, Mt. Wellington, November 25–30, 1922; 1 ♂, Hartz Mts., December 9, 1922 (*A. Tonnoir*).

Some of the specimens are conspicuously larger than others, but from the structure of the male hypopygium are conspecific. Superficially, *Molophilus duplex* resembles *M. parvistylus*, sp. n., the latter differing in the dark postnotum and dorso-pleural stripe and the small simple basal dististyle of the male hypopygium.

Molophilus variistylus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration dark brown; antennæ (♂) approximately as long as body, dark brown throughout, strongly nodulose; halteres dark; wings with a strong brown tinge; vein *2nd A* short; male hypopygium with the basistyle unarmed at apex; basal dististyle a powerful, curved, cylindrical rod, the apex oblique, acute, the base of the style with a pale, flattened, tail-like globe.

Male.—Length about 3–3·2 mm.; wing 4·2–4·8 mm.

Female.—Length 3·6–3·8 mm.; wing about 5 mm.

Rostrum and palpi dark brown. Antennæ (♂) approximately as long as the body, dark brown throughout, very strongly nodulose, the flagellar segments with large basal swellings that are provided with verticils of long erect setæ, the pedicils becoming longer on the outer segments. In the ♀ the antennæ are shorter, if bent backward extending about to the base of the halteres. Head dark brown.

Thorax shiny dark brown, the præscutum a trifle darker than the posterior notum. Pleura a little paler than the notum. Halteres pale at the base, the knobs infuscated, with dark brown setæ. Legs with the coxæ and trochanters

obscure testaceous yellow; remainder of legs brown, the terminal tarsal segments dark brown, the sclerites provided with dark setæ that are longer and more erect on the posterior tibiæ. Wings with a strong brown tinge, the veins a little darker; macrotrichiæ moderately dense, darker brown than the veins. Venation: basal section of R_{2+3} equal to or shorter than R_{4+5}, *r* opposite or just proximad of *r–m*; vein *2nd A* relatively short, ending some distance before the caudal end of *m–cu*, cell *2nd A* thus being relatively narrow.

Abdomen dark brown, including the hypopygium. Male hypopygium with the ventral lobe of the basistyle moderately long, narrowed outwardly, the apex blunt and provided with short dense setæ. Outer dististyle slender, bifid at apex, the inner arm acute and a little longer than the flattened, truncate, mesal arm. Basal dististyle a broad-based chitinized plate that soon narrows into a powerful, curved, chitinized rod, the apex of which is obliquely truncated into an acute point; caudo-mesal region of the style produced caudad into a conspicuous pale tail-like lobe. In some specimens the chitinized portion of the style is much more spinous than in others, there being a series of appressed spinulæ along the base of the narrowed portion, and, in cases, with one or two spines on the outer face just before the truncated apex. Ædeagus relatively long, gently curved, narrowed gradually to the acute apex. Tergal region relatively narrow, setiferous, the caudo-lateral angles more or less produced. Ovipositor with the tergal valves rather strongly upcurved, acute.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, December 2, 1922 (*A. Tonnoir*).

Allotype, ♀, National Park, December 17, 1922 (*A. Tonnoir*).

Paratopotype, ♂, November 26, 1922; *paratypes*, 1 ♂, Strahan, February 1924 (*G. H. Hardy*); 2 ♂♂, February 5, 1923 (*A. Tonnoir*); 1 ♂, 1 ♀, Zeehan, February 7, 1923; 1 ♂, King River, February 4, 1923; 2 ♂♂, 1 ♀, Lake Margaret, February 3, 1923; 2 ♂♂, Mt. Farrel, February 8, 1923; 1 ♂, Cradle Valley, January 27, 1923; 5 ♂♂, 1 ♀, National Park, December 15–16, 1922; 3 ♂♂, Eaglehawk Neck, Tasman Peninsula, November 17–20, 1922; 4 ♂♂, Adventure Bay, December 24–31, 1922; 1 ♂, Hartz Mts., December 9, 1922 (*A. Tonnoir*).

Mr. Hardy's paratype was included in extensive collections of Tasmanian Tipulidæ sent to me through the kindness of

the collector; the specimen is preserved in the collection of the University of Queensland.

Molophilus expansus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration of thorax reddish brown; antennæ of male elongate; head dark brownish grey; knobs of halteres brown; legs brown; wings with a brownish tinge; male hypopygium with the basistyles bilobed, the dorsal lobe very small, digitiform; basal dististyle a slender black rod that is expanded at apex into an elongate spinous head.

Male.—Length about 4 mm.; wing 6–6·1 mm.; antenna 3·2–3·3 mm.

Rostrum and palpi dark brown, the latter somewhat longer than usual. Antennæ elongate, in the male if bent backward extending to near mid-length of the abdomen, black throughout, the elongate-fusiform flagellar segments with conspicuous erect setæ. Head dark brownish grey.

Pronotum dark, the lateral pretergites yellowish. Mesonotum light brown to reddish brown, the median region of the præscutum sometimes darker, the lateral margins paler, almost yellowish brown; humeral region restrictedly brightened. Pleura yellowish brown, the dorsal region somewhat darker. Halteres with the extreme base pale, the remainder, with the knobs, dark brown. Legs with the coxæ and trochanters yellowish testaceous; femora yellowish brown, clothed with dark setæ; tibiæ and tarsi dark brownish black. Wings with a moderate strong brown tinge, the base and costal region more yellowish; veins dark brown, with somewhat darker macrotrichiæ. Venation: vein *2nd A* relatively short, ending about opposite the caudal end of *m–cu*; cells *Cu* and *1st A* at wing-margin of approximately equal width.

Abdomen dark brown. Male hypopygium with the basistyle bifid, the dorsal lobe appearing as a small, slender, finger-like lobule that is sparsely provided with long setæ; ventral lobe with apex obtusely rounded, the mesal face with delicate erect setulæ, the lateral face with fewer coarse setæ. Both dististyles borne in the notch of the basistyle; outer style trifid, the axis being produced into a straight acute spine, before the tip with a long obtuse arm that bears the third short branch in the axil near mid-length of the arm, this branch with some strong setæ. Basal or inner dististyle a heavily blackened straight rod that is expanded at apex into an elongate club, the apex spinous, the outer lateral angle with a larger straight or slightly curved spine, the

base of the club at the outer angle with one or two smaller spines directed basad. Ædeagus relatively slender.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 10, 1923 (*A. Tonnoir*).

Paratopotypes, 10 ♂ ♂, January 12–16, 1923; *paratypes*, 1 ♂, King River, February 4, 1923; 2 ♂ ♂, Hartz Mts., December 9, 1922 (*A. Tonnoir*).

Molophilus annexus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; closely allied to *M. ruficollis*, Skuse; mesonotum dark brown medially, the præscutum paler laterally; femora brown with a narrow yellow ring just before the tip; male hypopygium with the basal dististyle heavily chitinized, the apex with two divaricate unequal arms; gonapophyses not heavily chitinized as in *ruficollis*.

Male.—Length about 4·5–4·8 mm.; wing 6·1–6·6 mm.

Female.—Length 5–5·3 mm.; wing 7·2 mm.

Rostrum and palpi brownish black. Antennæ (♂) short, if bent backward extending about to the wing-root; scapal segments a trifle paler than the dark brown flagellum; flagellar segments elongate-oval to fusiform, with delicate pale pubescence and longer unilaterally arranged setæ. In the ♀ the antennæ are a little shorter with the flagellar segments correspondingly shortened. Head dark greyish brown.

Pronotum dark brown. Lateral pretergites light yellow. Mesonotal præscutum dark brown medially, paler, more reddish brown, laterally; humeral region obscure yellow; remainder of mesonotum dark brown. Pleura conspicuously dark brown. Halteres pale, the knobs orange-yellow with golden setæ. Legs with the coxæ and trochanters obscure yellow; femora pale brown, brighter at base, before the apex with a narrow yellow ring, this always broader than the dark apex beyond, the ring broadest on the posterior femora; tibiæ brownish yellow with dark setæ; ♂ with a conspicuous black subbasal ring; tarsi passing into brown. Wings obscure yellow, conspicuously variegated with brown, this including cells *C*, *Sc*, Sc_1, and *2nd* R_1, the elongate stigmal region remaining yellow and setiferous; prearcular region yellowish; a broad brown cloud on anterior cord; a narrow seam on posterior cord; bases of cells *Cu*, *1st A*, and *2nd A* extensively infuscated, especially the last-named cell; veins dark brown, the trichiæ still darker. Venation: *r* far beyond the level of *r–m*, the basal section of R_{2+3} being

approximately twice R_{4+5} ; vein *2nd A* long, extending to beyond mid-length of the petiole of cell M_3.

Abdomen dark brown, including the hypopygium, covered with dense erect pale setæ. Male hypopygium of the general type of *M. ruficollis*, Skuse; ventral lobe of basistyle long-produced, its mesal face with abundant dense setæ and setulæ; dorsal lobe of basistyle small and dark-coloured. Outer dististyle with the stem longer and more slender, the apex dilated and split quite as in *ruficollis*. Basal dististyle heavily chitinized, broad, the two apical arms divaricate, very unequal, the laterally directed one much the larger. Gonapophyses pale, only feebly chitinized, the margin pale and irregular. Ædeagus as in *ruficollis*, slender, subtended basally on either side by a narrow wing. Ninth tergite with median setæ. Ninth sternite with a dense group of median setæ.

Hab. Tasmania.

Holotype, ♂, Adventure Bay, December 30, 1922 (*A. Tonnoir*).

Allotype, ♀, Hartz Mts., December 9, 1922.

Paratopotypes, 2 ♂♂; *paratypes*, 2 ♂♂, 2 ♀♀, National Park, December 15–16, 1922; 2 ♂♂, Mt. Wellington, November 30, 1922; 4 ♂♂, Fern Tree, Mt. Wellington, November 12, 1922; 2 ♂♂, 1 ♀, Hartz Mts., December 9, 1922 (*A. Tonnoir*).

Molophyllus flavoannulatus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; closely allied to *M. ruficollis*, Skuse; general coloration dark brown; femora with a narrow yellow ring before the broader dark brown apex; wings greyish yellow, the macrotrichiæ brownish black, forming small darker patches on some of the veins; male hypopygium with the gonapophyses elongate, blackened, the tips acute.

Male.—Length about 3·3 mm.; wing 4·2 mm.

Female.—Length about 3·5 mm.; wing 4·5 mm.

Rostrum and palpi dark brown. Antennæ short, brownish black, the basal segment obscure yellow, brighter above; flagellar segments oval, the verticils short but dense. Head dark brownish grey.

Pronotum brown; lateral pretergites narrowly yellow. Mesonotum dark brown, the humeral region of the præscutum more reddish brown, the dorsum vaguely lined with paler. Pleura dark plumbeous brown, the dorsal-pleural membrane paler. Halteres pale, clothed with dark setæ. Legs with the

coxæ brownish testaceous, the middle coxæ darker; trochanters obscure yellowish testaceous; femora brown, the bases paler; each femur with a narrow yellow ring before the broader dark brown apex; tibiæ brown, their apices and the tarsi brownish black. Wings with a greyish-yellow tinge, the base and costal region clearer yellow; cord faintly clouded with darker; veins pale brown, macrotrichiæ brownish black and very dense, almost concealing the veins, forming dense patches at intervals along the veins, such being found on veins *M*, R_{2+3}, R_4, M_3, M_4, and the Anal veins. Venation: R_{4+5} short, about equal to the deflection of R_5; petiole of cell M_3 short, about one-half longer than *m–cu*; vein *2nd A* relatively short, ending about opposite the caudal end of *m–cu*.

Abdomen dark brown, the hypopygium obscure yellow, with the apices of the basistyles and the dististyles infuscated. Male hypopygium with the basistyles short and squat, the ventral portion produced caudad into a dusky lobe with long erect to retrorse setæ. Dististyles lying in a circular orifice that is swollen into a tumid margin provided with conspicuous setæ, especially on the cephalic portion. Outer dististyle elongate, bifid at apex, the two arms flattened, the outer extended laterad into a long triangular blade, the inner arm smaller with the apex truncated. Basal dististyle about two-thirds the length of the outer, slender, the base swollen, near mid-length dilated, the tip prolonged into a long straight spine. Gonapophyses appearing as long, gently curved rods that lie generally parallel to one another, the tips divergent, before the tips a little expanded, the extreme apex a sharp spine, before which, on the outer margin, is a group of short erect setæ. Ninth tergite small, narrowed to the truncated apex.

Hab. West Australia.

Holotype, ♂, Swan River (*J. Clark*).

Allotopotype, ♀.

Type in the collection of the National Museum, Victoria.

Molophilus plumbeiceps, sp. n.

Belongs to the *plagiatus* group; size small (wing, ♂, under 3·5 mm.); general coloration dark brown, the head leaden grey; vein *2nd A* very short, ending about opposite the origin of *Rs*; male hypopygium with the basal dististyle a simple, nearly straight rod.

Male.—Length 2·4–2·5 mm.; wing 3·2–3·3 mm.

Female.—Length about 2·8 mm.; wing 3·5–3·6 mm.

Rostrum and palpi brownish black. Antennæ short, if bent backward extending about to the wing-root; scapal segments ochreous, the flagellum dark brown; flagellar segments (♂) short-cylindrical to short-oval, with verticils that, while being short and inconspicuous, are still longer than the segments. Head very broad, closely applied to the thorax, dark leaden grey.

Pronotum very narrow, brown; anterior lateral pretergites obscure yellow, the posterior pretergites infuscated. Mesonotum dark greyish brown, the lateral margins and humeral region of the præscutum a trifle paler brown, the median area and scutal lobes somewhat leaden grey. Pleura dark brown, the dorso-pleural membrane a little paler. Halteres pale, the knobs infuscated. Legs with the coxæ and trochanters brownish testaceous; remainder of the legs yellowish brown, the femoral bases slightly paler, the terminal tarsal segments darker brown. Wings with a pale whitish-grey tinge, the wing-base more yellowish; veins and macrotrichiæ darker brown. Anal angle of wings sinuate. Venation: *r* lying just beyond *r–m*, the basal section of R_{2+3} relatively straight and subtransverse; R_{4+5} very short; petiole of cell M_3 very long, about equal to or only a little shorter than the cell; anal veins short, vein *1st A* ending about opposite or slightly beyond the caudal end of *m–cu*, vein *2nd A* very short, ending about opposite the origin of *Rs*.

Abdomen dark brown, including the hypopygium. Male hypopygium with the basistyles moderately short and stout, the apical beak deep and conspicuous, its tip acute. Dististyles placed rather close together; outer dististyle stout, bifid, the outer arm only moderately expanded, flattened, the apex with five or six small teeth; inner arm more cylindrical, the apex obtuse. Basal dististyle a simple slender rod, nearly straight, narrowed gradually to the acute tip. What appears to be the anal tube is a conspicuous, oval, densely setiferous median organ, the apex bilobed. Ædeagus relatively stout, about one-half longer than the basal dististyle. Ovipositor with the valves very slender, the tergal valves gently upcurved to the very acute tips.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, October 20, 1922 (*A. Tonnoir*).

Allotopotype, ♀, October 19, 1922.

Paratopotypes, 2 ♂♂, 1 ♀, October 19–21, 1922 (*A. Tonnoir*).

Molophilus electus, sp. n.

Belongs to the *plagiatus* group; general coloration pale yellow; male hypopygium with the basal dististyle a powerful black rod terminating in a long slender apical spine directed at a right angle, with a smaller subapical spine on the same face.

Male.—Length 2·8 mm.; wing about 3·8 mm.

Female.—Length about 3 mm.; wing about 4·5 mm.

Rostrum pale yellow, the palpi brown. Antennæ of moderate length, in ♂ if bent backward extending about to the wing-root; basal segments pale, the terminal segments slightly infuscated; flagellar segments (♂) long-oval with conspicuous erect white pubescence. Head pale yellow.

Thorax pale yellow to reddish yellow, the pleura pale yellow. In one specimen the thorax is more reddish brown, the mesonotum darker medially, the humeral region yellow, the pleura brownish testaceous. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters pale yellow; remainder of legs pale yellow, the tarsi passing into darker; base of fore tibia (♂) slightly dilated, but scarcely darker in colour. Wings with a pale yellow suffusion, the veins darker yellow; macrotrichiæ pale. Venation: *r* lying just beyond the level of *r–m*; vein *2nd A* relatively short, ending about opposite the caudal end of the oblique *m–cu*.

Abdomen pale yellow. Male hypopygium with the basistyles relatively long, the apical beak somewhat variable in shape in different specimens, varying from triangular to elongate, always surrounded by a group of conspicuous setæ. Outer dististyle rather widely separated from the basal style, the stem dilated at base, gently curved, the blackened apex dilated and not conspicuously bifid. Basal dististyle of very unusual form, a powerful black clavate rod, at the apex bent at right angles into a slender gently sinuous black spine that is only a little shorter than the stem alone; immediately basad of this terminal spine on the same face is a small acute spine. Ædeagus relatively short for a member of the group, about twice the length of the stem of the basal dististyle. Ovipositor with the valves relatively long, slender, only slightly arcuated.

Hab. Tasmania.

Holotype, ♀, Mt. Wellington, November 25, 1922 (*A. Tonnoir*).

Allotype, ♀, National Park, December 17, 1922.

Paratopotypes, 2 ♂♂, November 25–30, 1922; *paratypes*, 1 ♀, Eaglehawk Neck, Tasman Peninsula, November 15,

1922; 1 ♂, Adventure Bay, December 30, 1922; 1 ♂, Geeveston, November 7, 1922; 1 ♂, Hartz Mts., December 9, 1922 (*A. Tonnoir*).

Molophilus abortivus, sp. n.

Belongs to the *plagiatus* group; closely allied to *M. electus*, sp. n., differing in the structure of the male hypopygium.

Male.—Length about 3 mm.; wing 4·1 mm.

Female.—Length about 3·5 mm.; wing 4·3 mm.

Thorax pale reddish yellow. Halteres pale throughout.

Male hypopygium with the apical beak of the basistyle very slender, pale. Outer dististyle relatively short-stemmed, the head broadly dilated, curled into a partial circle, the inner angle relatively slender, the lateral angle broadly dilated. Basal dististyle a simple blackened rod, the apex directed laterad into a small acute black spine, with a slightly shorter, triangular tooth immediately basad of this on the same face, the two separated from one another by a U-shaped notch; the apical spine is less than one-fourth the length of the stem. Ædeagus pale, slender, gently sinuous, about one-half longer than the basal dististyle.

In the paratypes the spines of the basal dististyle are a trifle longer but subequal in length to one another, less than one-half the length of the stem, the basal spine more obtuse at apex.

Hab. Tasmania.

Holotype, ♂, Eaglehawk Neck, Tasman Peninsula, November 15, 1922 (*A. Tonnoir*).

Allotopotype, ♀, November 18, 1922.

Paratopotype, ♂; *paratypes*, 1 ♂, National Park, December 16, 1922; 1 ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Molophilus bucerus, sp. n.

Belongs to the *plagiatus* group; general coloration pale yellow; male hypopygium with the beak of the basistyle relatively deep, chitinized; basal dististyle slender, bifid near apex.

Male.—Length about 4 mm.; wing 4·9 mm.

Rostrum light yellow; palpi brown. Antennæ yellow, the terminal segments broken; if entire, the organ would be of moderate length, extending to between the wing and the haltere; flagellar segments long-oval with an erect white pubescence and long, unilaterally arranged verticils. Head light-yellow.

Pronotum and mesonotum yellow, indistinctly reddish yellow behind—this possibly caused by drying. Pleura pale yellow. Halteres light yellow throughout. Legs with the coxæ and trochanters yellow; only a single (middle) leg remains; yellow, the terminal two tarsal segments a trifle infuscated. Wings strongly tinged with yellow, the veins darker yellow; macrotrichiæ yellow. Venation: *r* lying almost opposite *r–m*; R_{4+5} shorter than the basal section of R_5: vein *2nd A* ending almost opposite the cephalic end of *m–cu*.

Abdomen pale yellow, including the hypopygium. Male hypopygium with the basistyle terminating in a deep chitinized beak, the outer margin oblique, the base surrounded by numerous setæ. Diststyles widely separated; outer diststyle large, the stem pale, relatively short, the outer arm a dilated blade, the inner arm a smaller, transversely flattened spine. Basal diststyle a long, slender, pale rod, nearly straight, extended into an apical blackened spine; at the base of the blackened portion with a smaller lateral spine closely appressed to the axis; distal half of style with small setiferous punctures. Ædeagus considerably shorter than the basal diststyle.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, October 22, 1922 (*A. Tonnoir*)

Molophilus bipectinatus, sp. n.

Belongs to the *plagiatus* group; closely allied to *M. translucens*, Skuse; general coloration pale yellow; base of antennæ, legs, and wings yellow; male hypopygium with the basal diststyle a powerful sickle-shaped rod, the outer margin provided with a double crest of strong spines, the apex further extended into a long slender spine.

Male.—Length 3·3–3·5 mm.; wing 4·8–5·2 mm.

Female.—Length about 4·5 mm.; wing 5·8–6 mm.

Rostrum brownish yellow; palpi dark brown. Antennæ (♂) short to moderate in length, if bent backward extending to just beyond the wing-root, the basal half or a little more pale yellow, thence passing into pale brown; flagellar segments elongate-oval. Head yellow.

Pronotum yellow, more reddish dorsally. Thorax yellowish testaceous, the lateral margin and humeral region pale yellow, the postnotum more dusted with white. Pleura pale yellow. Halteres pale, the knobs more yellow. Legs pale, the terminal tarsal segments infuscated. Wings pale yellow, the veins and macrotrichiæ a trifle darker. Venation: R_{4+5}

and basal section of R_5 subequal ; vein *2nd A* of moderate length, extending about to opposite *m–cu*.

Abdomen yellow, the styli black. In the female, the tergites are weakly infuscated medially. Male hypopygium with the basistyles produced at apex into a slender acute beak that is only feebly chitinized. Outer dististyle with the stem pale, the apex dilated, bifid, the lateral arm a semicircular flattened blade, separated from the short cylindrical mesal arm by a deep oval notch. Basal dististyle black, sickle-shaped, arising from a dilated pale base, the outer margin of the style with a double crest of conspicuous teeth, there being about six on either side, in addition to one or two smaller unpaired denticles at the ends of the row; apical fourth of style produced into a long, gently curved, acute tip; the dilated base, before the blackened stem, with a few setulæ. In a position of rest, these styli are directed caudad, the tips dorsad and more or less decussate. Ædeagus short, about equal in length to the basal dististyle, sinuous, the apex slender. Ovipositor with the valves relatively slender; pale yellow.

Hab. Victoria, Tasmania.

Holotype, ♂, Sassafras, Dandenong Range, October 19, 1922 (*A. Tonnoir*).

Allotype, ♀, Eaglehawk Neck, Tasman Peninsula, November 14, 1922.

Paratopotype, 1 ♀, October 22, 1922; *paratypes,* 1 ♂, with the allotype, November 22, 1922 ; 1 ♂, Fern Tree, Mt. Wellington, November 2, 1922 (*A. Tonnoir*).

Molophilus filistylus, sp. n.

Belongs to the *plagiatus* group ; allied to *M. bipectinatus*, sp. n. ; general coloration pale fulvous-yellow ; antennæ of male elongate ; vein *2nd A* relatively short ; male hypopygium with the basal dististyle an elongate straight rod extended into a long slender spine, the outer margin of the style with a row of from thirteen to fifteen small appressed spinules.

Male.—Length about 3·2 mm.; wing 4·6–4·8 mm.; antenna about 2·8 mm.

Rostrum yellow ; palpi beyond the basal segment brown. Antennæ (♂) elongate, only a little shorter than the body; scapal segments yellow, flagellar segments brown ; flagellar segments elongate, a trifle more dilated basally, each with a dense whorl of brown verticils. Head yellow.

Mesonotum shiny fulvous-yellow, with scattered erect

brown setæ. Pleura more yellowish. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters pale yellow; femora yellow with light brown setæ; tibiæ pale, with longer light brown setæ; tarsi pale, only the terminal two segments pale brown; posterior tibiæ almost white, with the setæ a little longer and more conspicuous than usual; fore tibia not dilated or darkened at base. Wings with a pale yellowish suffusion, the base brighter; veins darker yellow; macrotrichiæ relatively sparse, pale brown. Venation: *r* lying a little proximad of *r–m*; vein *2nd A* relatively short, ending some distance before the caudal end of *m–cu*.

Abdomen pale yellowish brown, the sternites more yellowish; hypopygium yellow, the styli black. Male hypopygium with the basistyles produced apically on mesal face into a slender, acute, blackened beak, its base surrounded by numerous setæ and setulæ. Outer dististyle blackened almost to the base, bifid at apex, the outer arm a little longer, microscopically tuberculate; inner arm short, glabrous, the apex obliquely truncated. Basal dististyle a very long, slender, straight rod, blackened almost to the base, the basal three-fourths more dilated, the outer margin with a row of about thirteen to fifteen small appressed spinules extended over more than one-half the length of the style, some of the spinules paired; apex of style beyond the spinules long, slender, almost straight. Ædeagus a trifle longer than the basal dististyle.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, October 20, 1922 (*A. Tonnoir*).

Paratopotype, ♂, October 19, 1922 (*A. Tonnoir*).

Molophilus gilvus, sp. n.

Belongs to the *plagiatus* group; general coloration of mesonotum pale reddish, the humeral region and lateral margins of the præscutum yellow; knobs of halteres pale; male hypopygium with the beak of basistyle large and conspicuous; basal dististyle slender, simple, about two-thirds the length of the ædeagus.

Male.—Length about 2·4–2·5 mm.; wing 4·3 mm.

Female.—Length about 3·5 mm.; wing 4·5 mm.

Rostrum pale yellow, the palpi short, brown. Antennæ short, if bent backward ending some distance before the wing-root; brownish yellow, the terminal segments somewhat darker; flagellar segments short-oval with long verticils.

the other pubescence short and inconspicuous. Head varying in different specimens from yellowish brown to dark brown.

Pronotum light yellow. Mesonotal præscutum pale reddish, the humeral region and lateral margins of the præscutum yellow; lateral pretergites bright sulphur-yellow; posterior sclerites of mesonotum light reddish, the scutellum with a small darker spot on either side. Pleura brownish yellow, the dorso-pleural membrane sulphur-yellow. Halteres pale, the knobs yellow. Legs with the coxæ and trochanters pale yellow; femora pale, a little darkened towards the tips, with inconspicuous dark setæ; tibiæ pale brownish yellow, the tips and the tarsi brown; legs relatively short and stout, especially in the female, the segments conspicuously hairy. Wings with a pale yellow tinge, the veins of the basal half brighter yellow, beyond the cord darker, with brown macrotrichiæ. Venation: r lying just proximad of r–m, the basal sections of R_{2+3} and R_{4+5} being subequal; vein *2nd A* moderately long, extending to shortly beyond the base of the petiole of cell M_3, cell *1st A* being gently narrowed on its outer portion.

Abdomen brownish yellow to yellowish brown, including the hypopygium. Male hypopygium as in the *plagiatus* group; basistyle with the apical beak large and conspicuous, but relatively slender, blackened; apex of style surrounding the beak with numerous large setæ. Outer dististyle very large and powerful, the stem stout, the inner arm acute, the lateral arm dilated, truncate, both arms and the end of the stem blackened. Basal dististyle a simple slender rod, narrowed to the slender acute apex, gently curved, approximately as long as the outer dististyle. In some specimens this style is blackened at apex, in others pale throughout. Ædeagus slender, about one-half longer than the basal dististyle.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 25, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotypes, 5 ♂♂, November 25–29, 1922; *paratypes*, 1 ♂, Geeveston, December 7, 1922; 1 ♂, Hobart, November 8, 1922; 2 ♂♂, 1 ♀, Fern Tree, Mt. Wellington, November 10–11, 1922; 1 ♂, Eaglehawk Neck, Tasman Peninsula, November 15, 1922 (*A. Tonnoir*).

Molophilus uniguttatus, sp. n.

Belongs to the *plagiatus* group; general coloration shiny reddish yellow, the pleura a little darker; wings tinged with

pale yellow, with a conspicuous pale brown blotch on the anterior cord; abdomen dark brown, the hypopygium reddish brown; male hypopygium with the basal dististyle a simple straight rod, rather stout, the apex with microscopic denticles.

Male.—Length about 3·2–3·5 mm.; wing 3·8–4·3 mm.

Rostrum dark brown, the palpi brownish black. Antennæ relatively short, if bent backward extending about to or just beyond the wing-root; pale brown, the terminal segments a little darker; flagellar segments oval, with a long, pale, erect pubescence and unilateral verticils. Head grey.

Pronotum yellow. Mesonotum shiny reddish, the mid-dorsum of the præscutum a little more testaceous; humeral region more yellow. Pleura shiny reddish brown, the central pleurites sometimes more darkened, the meron in cases a little darker. Halteres pale, the stem a trifle darker, the knobs light yellow. Legs with the coxæ and trochanters shiny reddish yellow; femora yellow, the tips somewhat darkened, the vestiture light brown, appressed; tibiæ pale testaceous yellow, the tips scarcely darkened; no subbasal ring on fore tibiæ of male; tarsi brown, the terminal segments passing into dark brown. Wings with a pale yellow tinge; a conspicuous pale brown blotch on the anterior cord, extending from the end of Sc_1 to *r–m*; posterior cord with a vague paler brown clouding; veins yellow, darker in the infuscated areas; macrotrichiæ relatively sparse, pale brown. Venation: *r* lying slightly beyond the level of *r–m*; vein *2nd A* relatively long, extending to slightly beyond the cephalic end of the oblique *m–cu*.

Abdomen dark brown, the hypopygium reddish brown. Male hypopygium as in the group; ninth tergite fringed with yellow setæ. Basistyles relatively slender, the apical beak moderately stout, the tip obtuse, its base surrounded by numerous long setæ. Dististyles rather approximated at bases. Outer dististyle with the stem relatively long and stout, blackened, the outer arm dilated, the inner arm a little shorter, subacute to obtuse. Basal dististyle a simple straight rod, rather stout and only moderately chitinized, the apex and for a short distance back from the tip with a few microscopic denticles. Ædeagus moderately slender, curved, with its basal enlargement a little longer than the basal dististyle.

Hab. Tasmania.

Holotype, ♂, Mt. Farrel, February 9, 1923 (*A. Tonnoir*).

Paratopotype, ♂.

III.—*On the Lower Carboniferous Corals: The Development of* Rylstonia benecompacta, *gen. et sp. n.* By R. G. S. Hudson, M.Sc., F.G.S., and Margery I. Platt, M.Sc.

[Plate I.]

Faunal assemblages of Zaphrentid phase are common at various horizons in the Lower Carboniferous of the Craven Lowlands. Such an assemblage is found in the lower beds of the Skelterton Limestone in the Flasby-Rylstone district*. Amongst the Zaphrentidæ of this faunal band is a form remarkable for the complex development of its columella and for the great variation of its structure both in the species and in the individual. Such corals, previously recorded from Rush, Derbyshire, etc., have been variously referred to *Cyathaxonia* or *Lophophyllum* and usually given the species name "*costata*," M'Coy. They differ, however, in a very marked degree from "*Cyathaxonia*" *costata*, M'Coy †, in the build of the central structure, and are here grouped in a new genus *Rylstonia* and their development described.

The authors record their thanks to Professor Marr for permission to examine the holotype of *Zaphrentis costata* and to Mr. R. G. Carruthers for information as to its structure. They also thank Dr. Lang for permission to examine the holotype of *Rylstonia contorta* and other specimens in the British Museum, Dr. Smyth for forwarding for examination his specimens of *Rylstonia*, and Principal Sibly for information as to localities in Derbyshire where *Rylstonia* might be collected.

Rylstonia, gen. nov.

Diagnosis.—Simple Rugose Corals, cornute or cylindrico-cornute, resembling *Caninia* (sensu stricto, non *Siphonophyllia*), but differing from these in having a columella which, usually prominent in a deep calyx and initially developed by the fusion of the septa

* The fauna of this Zaphrentid band and its position in the Lower Carboniferous sequence is recorded by Dr. Wilmore (Q. J. G. S. xlvi. 1910, pp 539–585) and by one of us and Miss K. Booker (Proc. Yorks. Geol. Soc. xx. 1926, pp. 411–438).

† *Zaphrentis costata* (M'Coy).—The holotype of *Cyathaxonia costata*, M'Coy—Specimen 311, Sedgwick Museum, Cambridge,—is a much broken specimen which it would be difficult to section. M'Coy's original description may be supplemented as follows:—The coral is conical, about 2·9 cm. long, with, in the mature growth-stage, a smooth epitheca showing faint growth-lines. There are approximately 22 straight and radial major septa with no marked fossula or minor septa. The tabulæ are much arched to the centre structure, which is formed by septa meeting in the centre and being united by secondary thickening forming an approximately cylindrical structure as in *Zaphrentis densa*, Carruthers (Geol. Mag. v. 1908, pl. iv. figs. 7–8). There are no dissepiments.

with a prolonged and swollen counter-septum, is, in the mature stage, a separate structure often reinforced by tabular deposition.

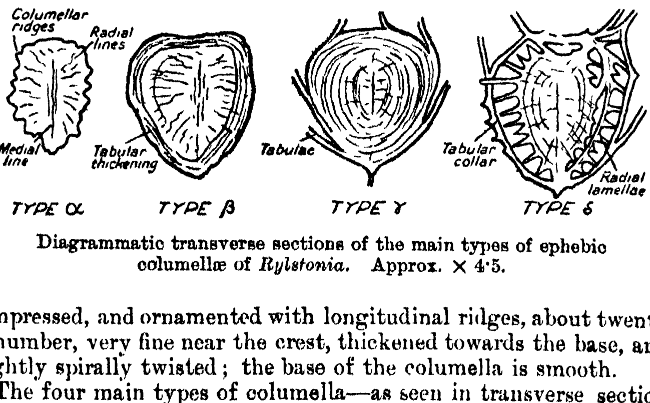
Distribution.—Upper Tournaisian and Viséan, Carboniferous, British Isles *. All specimens of *Rylstonia* yet found occur as part of a Zaphrentid phasal fauna, a fauna usually associated with shales and impure limestones.

Genotype.—*Rylstonia benecompacta*, sp. n.

The Morphology and Development of the Columella.

The ephebic columella of *Rylstonia* is very variable, but in all cases it is a composite structure built of the following skeletal elements:—the prolonged and swollen end of the counter-septum, the inner ends of the septa, and arched tabulæ—the whole structure more or less consolidated by secondary thickening. The relative importance of these elements varies at different stages in the individual and is also partly responsible for the differentiation of species and varieties.

The columella in the calyx is usually helmet-shaped, laterally



Diagrammatic transverse sections of the main types of ephebic columellæ of *Rylstonia*. Approx. × 4·5.

compressed, and ornamented with longitudinal ridges, about twenty in number, very fine near the crest, thickened towards the base, and slightly spirally twisted; the base of the columella is smooth.

The four main types of columella—as seen in transverse section just below the calyx—are diagrammatically represented in fig. 1. These types grade one into the other and intermediate forms are common. The columella is usually pyriform in transverse section, with its axis of symmetry corresponding to that of the coral and with its broad end towards the cardinal septum. This pyriform

* Amongst the corals of the Carboniferous of the United States of America there are certain columate forms usually referred to *Lophophyllum profundum*, Edwards and Haime. Certain of these forms have columellæ similar to that of *Rylstonia*. They differ from the species of *Rylstonia* described here mainly by the strong longitudinal ribbing of the epitheca. Such forms have been described by Dr. G. H. Girty in 'Fauna of the Wewoka Formation of Oklahoma,' Bull. 544, U.S. Geol. Survey, 1915, pp. 19–27, pl. ii. figs. 1 6 *a*.

shape is due to the absence of radial lamellæ corresponding to the cardinal septum and the strong influence of the radial lamella corresponding to the counter-septum, producing a broad and pointed end respectively. The central part of the ephebic columella is a compact solid axis with traces of a median line with radial growth-lines on either side, but in most cases the structure is indeterminate and can only be interpreted in the light of the structure of earlier stages. Where, as in type α, the central area is not surrounded by any other structure, the outline is toothed. This is due to the appearance in transverse section of the longitudinal ridges of the columella, the continuation of the radial lines. The columella in the calyx is in this condition (Pl. I. fig. 9). The additional thickening of the columella takes place at the base of the columellar invagination, and therefore does not affect the columella of the calyx. Below the calyx the central area of the columella is surrounded either by a collar-thickening which shows concentric growth-lines (types β and γ), or else by a network of radial lamellæ intersected by the cut edges of the collar-like tabulæ (type δ). The collar-thickening occasionally attains such a great thickness that the columella is one-third the diameter of the coral (type γ). Type β is characteristic of *R. benecompacta* and type δ of *R. benecompacta*, var. *dentata*.

Stage 1.—The Initial Columella. In early sections the counter-septum is prolonged into the central part of the coral. The axial end thickens more rapidly than the rest of the septum, producing a structure which may be regarded as the incipient columella (Pl. I. fig. 2 *f*). The "dark line" or line of centres of calcification of the counter-septum is continuous with that in the incipient columella only in the earliest stages. Later, the "dark line" is broken between the counter-septum and the columella in which it remains as the medial line (Pl. I. fig. 2 *e*). When this takes place, the columella may be said to originate as an independent structure, for it is virtually separate, though still attached to the counter-septum by the calcareous skeletal material deposited between them*. The stage at which the columella becomes a separate structure differs according to the species and variety; in some forms the coral has a considerable diameter before separation takes place, in others isolation takes place at a much smaller diameter.

Stage 2.—The Incorporation of the Axial Ends of the Septa. The extent of the incorporation of the septa in the columella is variable. Some sections show the septa coalescing with the incipient columella and the dark lines of the septa joining the dark

* The formation of the initial columella is similar to the formation of the columella of *Cyathaxonia*, as described by Mr. R. G. Carruthers (Geol. Mag. x. 1913, pp. 54–55).

line of the counter-septum with a pinnate arrangement. In most cases, however, this coalescing of the septa with the central structure was subsequent to the formation of the initial columella, for the lines of centres of calcification only pierce its outer limits and do not reach the medial line. This construction of the columella is similar to that of the mature *Zaphrentis costata*, in which the central structure is built of the fused ends of the septa surrounding an enlarged and extended counter-septum.

Later, the septal "dark lines" are broken and the septa retreat, leaving the septal ends incorporated in the columella. The detached ends of the septa rarely show as definite radial lamellæ; their gradual thickening as the columellar invagination retreats results in their fusion into the solid columella, in which they are indicated by the vertical ridges on the outside surface giving, in transverse section, a dentate margin to the columella (fig. 1, type *a*). The internal structure is only interpreted by the arrangement of the dark lines, here called radial lines, which are pinnate to the medial line. In later stages, when the septa advance into contact with the columella, they coalesce with the columella-ridges, but their septal lines are never continuous with the radial lines, showing that the secretion of the septal ends is now the function of the plicated edge of the columellar invagination. The dentations of the cross-section of the columella and the ridges of the columella in the calyx correspond in some cases with the number of septa, while in others they are not so numerous.

Stage 3.—The Incorporation of the Tabulæ. In the later stages of the columella the tabulæ become the main structural elements. It is at this stage that the development of the structure diverges, producing a columella either of β-type or one of δ-type.

The δ-type of Columella.—Here the tabulæ are steeply inclined to the columella, and arch upwards against it forming a series of collars. The spaces between the tabular collars are bridged by isolated radial lamellæ, which occur as small upright plates standing on the tabular collars and appearing in transverse section as radiating bars connecting the tabular rings, or as denticles on the outer surface of the last tabular ring. The lower part of the columellar invagination apparently lifted at intervals and, with a smooth surface, secreted the tabular collar around the existing "Stage 2" columella already secreted by the upper part of the columellar invagination. Later this secreting surface became plicated, built the radial lamellæ on the tabular collar, and then lifted again, repeating the process. This structure differs from the central column of the Clisiophyllids in that, in the latter, the septal lamellæ are continuous vertical plates with the axial tabellæ secreted between them and abutting against them; in the δ-type of *Rylstonia* columella the tabular collars are the continuous plates and the radial lamellæ are discontinuous.

The β-type of Columella.—In this type of columella secretion

occurred continuously around the previously constructed central area, so that an even collar-thickening is deposited, forming a compact columella with an entire edge. The lower part of the aboral invagination was apparently continuously smooth and never plicated, and, instead of secreting skeletal material at intervals as in the δ-type of columella and thus forming tabular collars, deposited it continuously as the polyp lifted. In such a columella, the central area, constructed of the initial columella and septal ends, is small and hardly to be distinguished from the encircling tabular collar.

Septal Development.

The septa in the early stages of *Rylstonia* are continuous vertical plates (Pl. I. fig. 3). Later, they become discontinuous and are built on tabulæ in the same way as the septa of *Caninia cornucopiæ* (R. G. Carruthers, Geol. Mag. v. 1908, p. 105). This structure is shown in figs. 8 & 10 *c*, Pl. I.—in fig. 10 *c* the discontinuous septum is the cardinal septum. The slight advance and retreat of the septa seen in serial transverse sections is due to this discontinuity of the structure. In transverse section all the septa built on the one tabula have their axial ends linked together by the cut edge of the tabula (Pl. I. figs. 7 *a*–7 *d*).

Secondary Thickening.

The early stages of *Rylstonia* resemble those of *Caninia cornucopiæ*, in that the spaces between the septa instead of being occupied with tabulæ are filled with the skeletal material usually referred to as "secondary thickening" (Pl. I. figs. 2 *e*–2 *h*). Although the coral skeleton is entirely calcareous, there is a slight difference in the material of the septa and the other vertical skeletal elements and that of the tabulæ and the "secondary thickening." The latter also shows no centres of calcification, as it is secreted by a single layer of epithelium (Dr. M. Ogilvie, "Microscopic and Systematic Study of Madreporarian Corals," Phil. Trans. Roy. Soc., 1896). The "secondary thickening" of the early stages is due to continuous secretion by the basal body-wall as it retreats to a higher level, filling in the space between the septa which have already been secreted at the summit of the septal invagination. The replacement of "secondary thickening" by tabulæ takes place in the counter-quadrants first (Pl. I. figs. 2 *a*–2 *d*).

Rejuvenescence.

The phenomenon of rejuvenescence, common in many Rugose Corals, has been variously attributed to the necessity for the polyp to counteract the automatic expansion of the calyx; to the construction, by a new polyp originating by transverse fission, of an immature structure in the old calyx; or to the return of the coral-

polyp to the immature structure of its earlier stages—a theory which underlies the name rejuvenescence.

The structural changes in *Rylstonia* may be grouped as follows:—

(1) The rapid change of the coral skeleton from the structure characteristic of the ephebic stage to an abnormal structure which contains new skeletal elements and with some of the normal elements missing.

(2) A gradual change from the abnormal to normal ephebic structure.

The marked features of the abnormal structure are:—

(i.) The absence of the columella and the replacement of the vaulted tabulæ by horizontal tabulæ which extend right across the coral (Pl. I. fig. 10 *a*).

(ii.) The withdrawal of the septa from the epitheca and the formation of large extra-septal dissepiments (Pl. I. fig. 5 *b*), some of which are seen, in longitudinal sections, to be vertical plates.

The structure at this stage can hardly be said to be that of any previous stage. It seems rather to be the result of a similar process to differentiation, a process that implies the simplification of the organism consequent on reduction of vitality. The simplification of the polyp, in this case, was probably the absence of the aboral invagination, an absence which would explain the lack of columella, the horizontal tabulæ, and the ring of extra-septal dissepiments. It is noteworthy that the abnormal structure is marked by a great reduction in the secretion of skeletal material; not only is the columella absent, but all secondary thickening has ceased and the septa, tabulæ, and extra-septal structures are all very slender, a feature not inconsistent with a reduction of vitality.

The first feature of the return to normal is the reduction in diameter of the corallite, usually effected by the reduction or cutting out altogether of the extra-septal dissepiments (Pl. I. fig. 5 *b*–5 *a*), and then the gradual return of the columella. The septa then extend to the epitheca and the corallite becomes normal.

Rejuvenescence does not always extend as far as the loss of the columella. Most irregularities in the corallite are due to the reduction in diameter brought about by the omitting of the ring of extra-septal dissepiments, or, where the contraction takes place before the extra-septal dissepimental stage, then the reduction takes place as far as the theca, eliminating, for the moment, the dissepiments. These minor constrictions are referred to as growth constrictions.

Rylstonia benecompacta, sp. n.

1908. *Cyathaxonia costata*, M'Coy, T. F. Sibly, Q. J. G. S. lxvi. p. 50 (record only).

1910. *Lophophyllum costata* (M'Coy), A. Wilmore, Q. J. G. S. lxvi. pp. 573–574, pl. xi. figs. 1–4.

1911. "*Cyathaxonia*" sp., A. Vaughan, Q. J. G. S. lxvii. pp. 558–559.

1926. *Cyathaxonia* sp., D. Parkinson, Q. J. G. S. lxxxii. p. 219 (record only).

Diagnosis.—*Rylstonia* with about 28 radial major septa. Solid columella, built on *Rylstonia* plan (β-type) with an outer tabular thickening, giving it, in cross-section, an entire and generally pyriform outline. Fossula conspicuous; minor septa and a thin ring of dissepiments.

Description.—*External Characters.* The corallite is cornute (Pl. I. figs. 1, 2, & 4) and, in the mature specimens, from 2·5 to 3 cm. long; occasional cylindrical specimens are found, and these are about 4 cm. long (Pl. I. fig. 6). The calyx which contains a laterally compressed columella averages 1·5 cm. in diameter and 1 cm. in depth (Pl. I. fig. 4). The fossula is on the convex side of the corallite. There is no ornament on the epitheca other than the annular growth-striations. Growth-restrictions are rare in the cornute, but more common in cylindrical specimens.

Internal Characters.—*Transverse Sections.* There are about 28 major septa. The cardinal septum is short and occupies a broad, well-marked fossula; the counter-septum may be distinguished only when it remains in contact with the columella after the other septa have shortened. The septa in the ephebic corallite are "caninoid." Minor septa are short; dissepimental rings are few in cornute specimens, and may be absent following a growth-restriction, in cylindrical specimens the dissepimental area is larger (Pl. I. fig. 5 *a*, 5 *b*). Extra-septal dissepiments are occasionally developed, but are only abundant when accompanying "rejuvenescence." The columella is of β-type.

Longitudinal Sections.—The tabulæ are arched towards the columella, close to which they become nearly vertical and pass into the tabular collar-thickening of the columella. The theca is well marked, the thecal dissepiments tending to be vertical.

Distribution.—*Dibunophyllum* zone, Visean, Lower Carboniferous, British Isles.

Rylstonia compacta is a characteristic species of the Pendleside Limestone Series and, as such, is found chiefly in the Central Province. It is fairly abundant in the *Cyathaxonia*-beds of Bradbourne, Derbyshire, and in the Skelterton Limestone of the Craven Lowlands. It has been collected by Dr. Parkinson from the Ravensholme Limestone near Clitheroe, and by Dr. L. B. Smyth from the *Cyathaxonia*-beds of Rush (locality L 1, Matley and Vaughan, Q. J. G. S. 1908, lxiv. p. 416). The only record outside the Central Province is that of Vaughan (1911, *loc. supra cit.*) from North Colts Hill Quarry, Oystermouth, Gower, S. Wales. Specimen R. 23102 in the Wheelton Hind Collection, British Museum, is an immature *R. benecompacta*.

Holotype. R. 25563. British Museum (Pl. I. fig. 1). Skelterton Limestone, Carlton Gill Quarry, near Rylstone, Yorkshire.

Rylstonia benecompacta, var. *dentata*, nov.

1906. "*Cyathaxonia*" aff. *costata*, M'Coy, A. Vaughan, Q. J. G. S. lxii. p. 318, pl. xxix. fig. 5 *. R. 22077 and 22105.

1908. *Cyathaxonia costata*, M'Coy (pars), T. F. Sibley, Q. J. G. S. lxiv. p. 50 (record only).

Diagnosis.—A variety of *Rylstonia benecompacta* in which the columella is of δ-type, that is, partially vesicular with an outer zone of radial lamellæ and tabular collars and in transverse section a dentate outline.

Remarks.—The general structure of *R. benecompacta*, var. *dentata*, is slightly more advanced than that of *R. benecompacta*: the septa become caninoid in the neanic stage; secondary thickening is much rarer, growth-restrictions and rejuvenescence are more common. The external appearance is similar to that of fig. 6, Pl. I.

Distribution.—As for *Rylstonia benecompacta.*

Holotype. British Museum, R. 25581–5 (Pl. I. figs. 7 *a*–7 *d*). Skelterton Limestone, Clints Quarry, near Rylstone, Yorkshire.

Ontogeny of Rylstonia benecompacta.

Most corallites of *Rylstonia* are single individuals, but occasionally specimens are found in which the young corallite is attached to the inner edge of the calyx of a mature individual (Pl. I. fig. 4), an attachment which may be fortuitous or may be the result of calicular gemmation. Dr. G. H. Girty figures a similar attachment of "*Lophophyllum profundum*" (*op. cit.* pl. 71. figs. 6 & 6 *a*) and attributes it to calicular gemmation.

Five development stages can be recognized:—

(*a*) Brephic: The early brephic stage in which the six primary septa are formed has not been recognized. The earliest stage examined—the late brephic stage—shows, in a section of 2 to 3 mm. diameter, 14 very crowded septa (Pl. I. fig. 2 *h*). The cardinal septum is slightly shortened, the counter is slightly lengthened and joins the other four primary septa. The eight elementary metasepta are pinnately arranged. There is no trace of a columella.

(*b*) Early Neanic (Columella in Stage I.): In this stage the septa increase from 14 to 24, still with a pinnate arrangement. Minor septa are indicated by ridges on the inside of the epitheca. At the beginning of this stage the axial end of the counter-septum becomes swollen (Pl. I. fig. 2 *g*), and later the septal ends begin to be incorporated in this incipient columella (Pl. I. fig. 2 *f*).

(*c*) Middle Neanic (Columella in Stage II.): The columella, which early on in this stage separates from the counter-septum

* R. 22105, the section reproduced in fig. 5, is a transverse section cut immediately below a growth-restriction and, therefore, shows extra-septal dissepiments.

(Pl. I. fig. 2 *e*), increases by the incorporation of the septal ends and becomes pyriform. The cardinal septum shortens, a fossula is formed, and tabulæ appear as secondary thickening ceases (Pl. I. figs. 2 *d* & 7 *d*).

(*d*) Late Neanic (Columella in Stage III.): At the beginning of this stage, the major septa attain their full number and become radial, minor septa develop, and tabular thickening or tabular rings and radial lamellæ convert the columellæ into one of β- or δ-type (Pl. I. figs. 2 *b*, 2 *c*, 7 *b*, 7 *c*). Many specimens do not advance beyond this stage.

(*e*) Ephebic Type. Dissepiments are formed (Pl. I. figs. 2 *a* & 7 *a*). Only in occasional cylindrical specimens does the dissepimental zone attain any great width (Pl. I. figs. 5 *b* & 9).

Rylstonia contorta (Vaughan).

1906. *Cyathaxonia contorta*, Vaughan, Q. J. G. S. lxii. pp. 301 & 317–318, pl. xxix. figs. 4 & 4 *a*.

Holotype. British Museum, R. 22074. *Cyathaxonia*-beds, Rush, Co. Dublin. Fig. 4 *a*, pl. xxix., Vaughan, *loc. cit.*, was cut from the holotype.

Rylstonia contorta differs from *R. benecompacta* in that it has about 40 septa, no dissepiments or secondary septa. The columella is of β-type, but partially vesicular. The horizon of *R. contorta* is uncertain. The *Cyathaxonia*-beds of Rush were placed by Vaughan in the upper part of the *Dibunophyllum*-zone; it is more probable that they are of D_1 or S_2 age.

Rylstonia sp.

1920. *Lophophyllum* cf. *costatum*, M'Coy, L. B. Smyth, Sci. Proc. Roy. Dub. Soc. xvi. (n. s.) no. 2, pp. 21–22, pl. 1. fig. 6.

The description of this species, an early form of *Rylstonia* from C_1, Malahide, Ireland, is postponed pending the examination of further material.

Comparison and Affinities of Rylstonia.

The septal plan of *Rylstonia* links it with the more advanced Zaphrentidæ, such as *Caninia cornucopiæ*, mut. $D_{2\text{-}3}$, Vaughan, and *C. vesicularis*, Salée. From such forms it differs in the possession of a columella, a structure which is paralleled in other groups of the Rugose corals, but is not found in other genera of the Zaphrentidæ. Other Zaphrentidæ, however, show in their ephebic stages structures which may be paralleled with the early columellar structure of *Rylstonia*. The ephebic stage in *Zaphrentis eruca* is similar to the early neanic stage in *Rylstonia* before the separation of the initial columella; the initial columella itself is comparable to that of the mature *Lophophyllum tortuosum* or to *Cyathaxonia*; while the columella of *Rylstonia* before the

separation of the septal ends may be compared to the central structure of *Zaphrentis costata*.

A comparison of the structure of the network of the central column of the Clisiophyllids with the solid columella of *Rylstonia* shows a parallel convergence in the adaptation of the same skeletal elements to produce different structures apparently fulfilling a common purpose. The central column of the Clisiophyllidæ is built of a medial plate, septal lamellæ, and tabellæ; the columella of *Rylstonia benecompacta* shows in its medial line, radial lines, and tabular columella the influence of the same skeletal elements—namely, counter-septum, axial ends of the septa, and arched tabulæ.

The columellæ of *Amygdalophyllum* and *Cionodendron* represent a similar development in the Cyathophyllidæ and Lithostrotionidæ respectively.

EXPLANATION OF PLATE I.

Rylstonia benecompacta and variants. All from the *Zaphrentis*-bed, Skelterton Limestone. Fig. 1 from Calton Gill Quarry, and figs. 2 12 from Clints Quarry, both near Rylstone, Yorkshire. All transverse sections are orientated with the cardinal fossula towards the top of the Plate.

Figs. 1-5. *Rylstonia benecompacta*, gen. et sp. n.

Fig. 1. Holotype, natural size. British Museum, R. 25563. Calyx broken away to show columella.

Fig. 2. Paratype, natural size. Specimens from which transverse sections of 2 *a*–2 *h* (R. 25565-72) were cut. Fig. 2 *a*, early ephebic stage, × 1·5; fig. 2 *b*, from top of late neanic stage, × 1·5; fig. 2 *c*, base of late neanic stage, × 1·5; fig. 2 *d*, top of middle neanic stage, × 1·5; fig. 2 *e*, base of middle neanic stage, × 2; fig. 2 *f*, top of early neanic stage, × 2; fig. 2 *g*, base of early neanic stage, × 2; fig. 2 *h*, late brephic stage, × 4.

Fig. 3. Longitudinal section, × 1·5. R. 25573.

Fig. 4. Calicular view showing attachment of young corallite, natural size. R. 25574.

Fig. 5. Transverse sections cut from a cylindrical specimen showing, in fig. 5 *b*, extra-septal dissepiments due to differentiation, and in fig. 5 *a* normal structure after regeneration. Natural size. R. 25575–6.

Fig. 6. *Rylstonia benecompacta* towards var. *dentata*. Cylindrical corallite. Natural size. R. 25580.

Figs. 7–10. *Rylstonia compacta*, var. *dentata*, nov.

Fig. 7. Tranverse sections from holotype, ×1·5. R. 25581–3, 25585. Fig. 7 *a*, early ephebic; figs. 7 *b* & 7 *c*, late neanic; fig. 7 *d*, middle neanic.

Fig. 8. Longitudinal section, × 1·5. R. 25586.

Fig. 9. Transverse section through base of calyx showing calicular columella. Late ephebic stage. × 1·5. R. 25587.

Fig. 10. Two longitudinal sections and one transverse section from a cylindrical corallite showing "rejuvenescence," × 1·5. R. 25588–90. Fig. 10 *b* shows the ephebic stage; fig. 10 *a*, the contraction of the corallite and the absence of the columella, etc. (see p. 44).

Fig. 11. *Rylstonia* aff. *benecompacta* (γ-type of columella). Calyx broken away. Natural size. R. 25591.

Fig. 12. The same. Transverse section just below the calyx, × 1·5. R. 25592.

IV. — *Additions to the Marine Fauna of St. Andrews since* 1874. By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c., Gatty Marine Laboratory, St. Andrews.

[Continued from vol. xviii. p. 266.]

PARASITIC WORMS IN THE ST. ANDREWS FAUNA †.

(A) TREMATODES.

(I.) In Birds.

Order DIGENEA.

Superfamily **Distomata.**

Family **Psilostomidæ**, Looss.

Genus PSILOSTOMUM, Looss.

P. brevicolle (Creplin) in the intestine of the common scoter (*Oidemia nigra*), the long-tailed duck (*Clangula hyemalis*), and the oyster-catcher (*Hæmatopus ostralegus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xx. p. 66.
Odhner, Zool. Anzeig. xlii. p. 289.

Family **Echinostomidæ**, Looss.

Genus HIMASTHLA, Dietz.

H. militaris (Rud.), Dietz, in the intestine of the curlew (*Numenius arquata*).

Nicoll, Parasitology, xv. p. 189.
Dietz, Zool. Jahrb. Syst. xii., Suppl. p. 265.

H. leptosoma (Crep.) in the intestine of the dunlin (*Tringa alpina*), the sanderling (*Calidris arenaria*), the oyster-catcher (*Hæmatopus ostralegus*), and the turnstone (*Arenaria interpres*).

Nicoll, Parasitology, xv. p. 151.
Dietz, Zool. Jahrb. Syst. xii., Suppl. p. 265.

H. elongata (Mehlis) in the intestine of the herring-gull (*Larus argentatus*) and the black-headed gull (*Larus ridibundus*).

Nicoll, Parasitology, xv. p. 165.
Dietz, Zool. Jahrb. Syst. xii., Suppl. p. 265.

† I am indebted to Dr. Wm. Nicoll, who has made a special study of the group, for the following account of the Parasitic Worms of marine forms at St. Andrews.

Genus PARORCHIS, Nicoll.

P. acanthus, Nicoll, in the Bursa Fabricii and rectum of the herring-gull (*Larus argentatus*) and the common gull (*Larus canus*).

Nicoll, Quart. Journ. Micr. Sci. li. p. 345.
Lebour & Elmhirst, Journ. Mar. Biol. xii. p. 829.

Family **Schistosomidæ**, Looss.

Genus GIGANTOBILHARZIA, Odhner.

G. acotylea, Odhner, in the abdominal veins of the black-headed gull (*Larus ridibundus*).

Nicoll, Parasitology, xv. p. 158.
Odhner, Zool. Anzeig. xxxv. p. 380.

Family **Plagiorchidæ**, Lühe.

Genus PLAGIORCHIS, Lühe.

P. notabilis, Nicoll, in the intestine of the wagtail (*Motacilla flava*) and the rock-pipit (*Anthus petrosus*).

Nicoll, Quart. Journ. Micr. Sci. liii. p. 475.

Family **Heterophyidæ**, Odhner.

Genus CRYPTOCOTYLE, Lühe.

C. concava (Crep.) in the intestine of the shag (*Phalacrocorax graculus*), long-tailed duck (*Clangulus hyemalis*), common scoter (*Oidemia nigra*), and razor-bill (*Alca torda*).

Nicoll, Quart. Journ. Micr. Sci liii. p. 483.
Ransom, Proc. U.S. Nat. Mus. lvii. p. 527.

C. lingua (Crep.) in the intestine of the herring-gull (*Larus argentatus*) and the greater black-backed gull (*Larus marinus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xx. p. 66.
Jägerskiöld, Bergens Mus. Aarbog, ii. p. 7.

C. jejuna (Nicoll) in the intestine of the redshank (*Totanus totanus*).

Nicoll, Quart. Journ. Micr. Sci. liii. p. 483.
Ann. & Mag. Nat. Hist. (7) xx. p. 66.

Genus LEVINSENIELLA, Stiles & Hassall.

L. brachysoma (Crep.) in the intestine of the long-tailed duck (*Clangula hyemalis*), common scoter (*Oidemia nigra*),

dunlin (*Tringa alpina*), redshank (*Totanus totanus*), lapwing (*Vanellus vanellus*), oyster-catcher (*Hæmatopus ostralegus*), and turnstone (*Arenaria interpres*).

Nicoll, Quart. Journ. Micr. Sci. liii. p. 482.
Jägerskiöld, Zool. Stud. till T. Tullberg, 1907, p. 133.

L. pygmæa (Levinsen) in the intestine of the eider-duck (*Somateria mollissima*) and common scoter (*Oidemia nigra*).

Nicoll, Parasitology, xv. p. 168.
Jägerskiöld, Centralbl. f. Bakteriol. 1ste Abt. xxvii. p. 732.

Genus SPELOTREMA, Jägerskiöld.

S. claviforme (Brandes) in the intestine of the blue-headed wagtail (*Motacilla flava*), rock-pipit (*Anthus petrosus*). dunlin (*Tringa alpina*), curlew (*Numenius arquata*), and black-headed gull (*Larus ridibundus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xx. p. 254; Quart. Journ. Micr. Sci. liii. p. 480.

S. simile (Jägerskiöld) in the intestine of the herring-gull (*Larus argentatus*), black-headed gull (*Larus ridibundus*), and oyster-catcher (*Hæmatopus ostralegus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xx. p. 254.
Jägerskiöld, Centralbl. f. Bakter. 1ste Abt. xxvii. p. 732.

S. excellens, Nicoll, in the intestine of the herring-gull (*Larus argentatus*) and the oyster-catcher (*Hæmatopus ostralegus*).

Nicoll, ibid. p. 248; Quart. Journ. Micr. Soc. liii. p. 481.
Jägerskiöld, Centralbl. f. Bakter. (i.) xlviii. p. 302.

Genus MARITREMA, Nicoll.

M. humile, Nicoll, in the intestine of the redshank (*Totanus totanus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xx. p. 66; Quart. Journ. Micr. Soc. liii. p. 484.
Jägerskiöld, Centralbl f. Bakter. (i.) xlviii. p. 302.

M. gratiosum, Nicoll, in the intestine of the dunlin (*Tringa alpina*), ringed plover (*Ægialitis hiaticula*), oyster-catcher (*Hæmatopus ostralegus*), and black-headed gull (*Larus ridibundus*).

Nicoll, ibid.

M. lepidum, Nicoll, in the intestine of the herring-gull (*Larus argentatus*).
Nicoll, ibid.

Genus Gymnophallus, Odhner.

G. dapsilis, Nicoll, in the intestine and Bursa Fabricii of the common scoter (*Oidemia nigra*) and velvet scoter (*Oidemia fusca*).
Nicoll, ibid.

Superfamily **Monostomata**.

Family **Notocotylidæ**, Lühe.

Genus Notocotylus, Diesing.

N. attenuatus (Rud.) in the intestine and pyloric cœca of the long-tailed duck (*Clangula hyemalis*), eider-duck (*Somateria mollissima*), lapwing (*Vanellus vanellus*), and oyster-catcher (*Hæmatopus ostralegus*).
Odhner, Fauna Arctica, iv. (2) p. 291.
Kossack, Zool. Jahrb. Syst. xxxi. p. 491.

Genus Catatropis, Odhner.

C. verrucosa (Froel.) in the intestine and pyloric cœca of the long-tailed duck (*Clangula hyemalis*), the eider-duck (*Somateria mollissima*), and the common scoter (*Oidemia nigra*).
Odhner, ibid.
Kossack, ibid.

(II.) In Fishes.

Suborder **PROSOSTOMATA**.

Superfamily **Distomata**.

Family **Allocreadiidæ**, Stossich.

Genus Podocotyle (Dujardin).

P. atomon (Rud.) in the intestine of the father-lasher (*Cottus scorpius*), bull-head (*Cottus bubalis*), Montague's sucker (*Cyclogaster montagui*), goby (*Gobius ruthensparri*), butterfish (*Centronotus gunnellus*), viviparous blenny (*Enchelyopus viviparus*), three-spined stickleback (*Gasterosteus aculeatus*), five-spined stickleback (*Gastræa spinachia*), five-bearded rockling (*Onos mustela*), and the three-bearded rockling (*Onos tricirratus*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 73.
Odhner, Fauna Arctica, iv. (2) p. 320.

Genus LEBOURIA, Nicoll.

L. idonea, Nicoll, in the intestine of the catfish (*Anarrhichas lupus*).
Nicoll, Quart. Journ. Micr. Sci. liii. p. 441.

L. varia, Nicoll, in the intestine of the dragonet (*Callionymus lyra*).
Nicoll, Parasitology, iii. p. 322.

Genus STEPHANOCHASMUS, Looss.

S. baccatus, Nicoll, in the intestine of the father-lasher (*Cottus scorpius*) and halibut (*Hippoglossus vulgaris*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 66; Parasitology, vi. p. 190.

S. triglæ, Lebour, in the intestine of the grey gurnard (*Trigla gurnardus*).
Lebour, Northumberland Sea Fisheries Report for 1907, p. 11.

Genus ACANTHOPSOLUS, Odhner.

A. lageniformis, Lebour, in the intestine of the catfish (*Anarrhichas lupus*).
Lebour, ibid. (1909), p. 29.

Genus LEPIDAPEDON, Stafford [=LEPODORA, Odhner].

L. rachion (Cobbold) in the intestine of the haddock (*Gadus æglefinus*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 77.
Odhner, Fauna Arctica, iv. (2) p. 332.

Genus PHARYNGORA, Lebour.

P. bacillaris (Molin) in the intestine of the lumpsucker (*Cyclopterus lumpus*).
Lebour, Northumberland Sea Fisheries Report for 1907, p. 11.

Genus DIHEMISTEPHANUS, Looss.

D. lydiæ (Stossich) in the intestine of the sunfish (*Mola mola*).
Nicoll, Ann. & Mag. Nat. Hist. (8) iv. p. 11.
Looss, Centralbl. f. Bakter. 1ste Abt. xxix. p. 605.

Family **Fellodistomidæ**, Nicoll (=*Steringophoridæ*, Odhner).

Genus FELLODISTOMUM, Stafford.

F. fellis (Olsson) in the gall-bladder of the catfish (*Anarrhichas lupus*).
Nicoll, Quart. Journ. Micr. Sci. liii. p. 458.
Jacoby, Archiv f. Naturg. lxvi. p. 12.

F. agnotum, Nicoll, in the duodenum of the catfish (*Anarrhichas lupus*).
Nicoll, ibid. p. 469.
Odhner, Zool. Anzeig. xxxviii. p. 97.

Genus STERINGOPHORUS, Odhner.

S. furciger (Olsson) in the intestine of the dab (*Pleuronectes limanda*).
Odhner, Fauna Arctica, iv. (2) p. 291.
Lebour, Northumberland Sea Fisheries Report (1907), p. 11.

Family **Zoogonidæ**, Odhner.

Genus ZOOGONUS, Looss.

Z. rubellus (Olsson) in the intestine of the catfish (*Anarrhichas lupus*).
Nicoll, Ann. & Mag. Nat Hist. (8) iv. p. 17.
Odhner, Zoolog. Anzeig. xxxvii. p. 237.

Genus ZOOGONOIDES, Odhner.

Z. viviparus (Olsson) in the intestine of the dragonet (*Callionymus lyra*), catfish (*Anarrhichas lupus*), turbot (*Bothus maximus*), dab (*Pleuronectes limanda*), lemon-dab (*Pleuronectes microcephalus*), and plaice (*Pleuronectes platessa*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 83.
Odhner, Centralbl. f. Bakter. (1) xxxi. p. 62.

Family **Hemiuridæ**, Lühe.

Subfamily *HEMIURINÆ* (Looss).

Genus HEMIURUS, Rud.

H. communis, Odhner, in the stomach and intestine of the father-lasher (*Cottus scorpius*), bull-head (*Cottus bubalis*), grey gurnard (*Trigla gurnardus*), butter-fish (*Centronotus gunnellus*), haddock (*Gadus æglefinus*), cod (*Gadus callarias*),

sand-eel (*Ammodytes tobianus*), halibut (*Hippoglossus vulgaris*), and eel (*Anguilla anguilla*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 86.
Looss, Zool. Jahrb., Syst. xxvi. p. 63.

H. lühei, Odhner, in the stomach of the grey gurnard (*Trigla gurnardus*), herring (*Clupea harengus*), and the sprat (*Clupea sprattus*).
Nicoll, Ann & Mag. Nat Hist. (8) iv. p. 21.
Odhner, Fauna Arctica, iv. (2) p. 291.

Subfamily *Sterrhurinæ*, Looss.

Genus Lecithochirium, Lühe.

L. rufoviride (Rud.) in the stomach of the eel (*Anguilla anguilla*).
Lühe, Zool. Anzeig. xxiv. p. 394.
Looss, Zool. Jahrb., Syst. xxvi. p. 63.

Genus Brachyphallus, Odhner.

B. crenatus (Rud.) in the stomach of the sand-eel (*Ammodytes tobianus*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 88.
Looss, Zool. Jahrb., Syst. xxvi. p. 63.

Subfamily *Lecithasterinæ*, Odhner.

Genus Lecithaster, Lühe.

L. gibbosus (Rud.) in the intestine and stomach of the dragonet (*Callionymus lyra*), red gurnard (*Trigla pini*), dab (*Pleuronectes limanda*), halibut (*Hippoglossus vulgaris*), smelt (*Osmerus eperlanus*), and sprat (*Clupea sprattus*).
Nicoll, Ann. & Mag. Nat. Hist. (8) iv. p. 18.
Looss, Zool. Jahrb., Syst. xxvi. p. 63.

Genus Lecithophyllum, Odhner.

L. botryophoron (Olss.) in the intestine of *Argentina sphyræna*.
Odhner, Fauna Arctica, iv. (2) p. 391.

Subfamily *Syncœliinæ*, Looss.

Genus Derogenes, Lühe.

D. varicus (O. F. Müller) in the stomach of the father-lasher (*Cottus scorpius*), bull-head (*Cottus bubalis*), dragonet

(*Callionymus lyra*), grey gurnard (*Trigla gurnardus*), cod (*Gadus callarias*), whiting (*Gadus merlangus*), turbot (*Bothus maximus*), brill (*Bothus rhombus*), dab (*Pleuronectes limanda*), halibut (*Hippoglossus vulgaris*), and sprat (*Clupea sprattus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 90.
Odhner, Fauna Arctica, iv. (2) p. 391.

Family **Heterophyidæ**, Odhner.

Genus GALACTOSOMUM, Looss.

G. lacteum, Jägerskiöld, encysted in the head of the bull-head (*Cottus bubalis*).

Jägerskiöld, Zool. Stud. Festschrift W. Lilljeborg, p. 165.

Suborder **GASTEROSTOMATA**.

Family **Bucephalidæ**, Poche.

Genus PROSORHYNCHUS, Odhner.

P. squamatus, Odhner, in the cœca and duodenum of the bull-head (*Cottus bubalis*).

Odhner, Fauna Arctica, iv. (2) p. 391.
Lebour, Northumberland Sea Fisheries Report for 1907, p. 11.

Genus RHIPIDOCOTYLE, Diesing.

R. minima (Wagener) in the intestine of the grey gurnard (*Trigla gurnardus*).

Nicoll, Journ. Mar. Biol. Assoc. x. p. 492.

(III.) In Invertebrates.

Cercaria of *Himasthla militaris* (Rud.) [*Echinostomum secundum*, Nicoll] in cysts in the mantle-edge and foot of the cockle (*Cardium edule*) and mussel (*Mytilus edulis*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xvii. p. 148.

Cercaria of *Gymnophallus dapsilis*, Nicoll, in sporocysts in the liver of the mussel (*Mytilus edulis*).

Nicoll, ibid.

Cercaria of *Spelotrema excellens*, Nicoll, in cysts in the liver, gonads, &c., of *Carcinus mænas* and *Cancer pagurus*.

Nicoll and Small, Ann. & Mag. Nat. Hist. (8) iii. p. 238.
M'Intosh, Quart. Journ. Micr. Sci. v. p. 201.

(B) CESTODES.

(I.) In Birds.

Order CYCLOPHYLLIDEA, v. Ben.

Family **Tetrabothriidæ**, Monticelli.

Genus TETRABOTHRIUS, Rud.

T. erostris, Lönnberg, in intestine of the common gull (*Larus canus*) and the herring-gull (*Larus argentatus*).
Lönnberg, Bihang Svensk-Vetensk. Akad. Handl. xiv. (4) no. 9; Fuhrmann, Centralbl. f. Bakt. xxv. p. 873.

T. macrocephalus, Rud., in the intestine of the red-throated diver (*Colymbus stellatus*).
Fuhrmann, Centralbl. f. Bakt. xxv. p. 873.
Lühe, Die Süsswasserfauna Deutschlands, xviii. p. 42.

Family **Hymenolepididæ**, Raill. & Henry.

Genus HYMENOLEPIS, Weinland.

H. microsoma (Creplin) in the intestine of the velvet scoter (*Oidemia fusca*).
Krabbe, K. Dansk. Vid. Selsk. Skrift. (5) viii. p. 296.
Cohn, Nova Act. Acad. Nat. cur. Halle, lxxix. p. 284.

H. tenuirostris (Rud.) in the intestine of the velvet scoter (*Oidemia fusca*).
Stiles, Bull. No. 12, Bur. Anim. Indust., U.S. Dept. of Agriculture, p. 43.
Cohn, Nova Acta Acad. Nat. cur. Halle, lxxix. p. 326.

H. passeris (Dujard.) in the intestine of the sparrow (*Passer domesticus*).
Krabbe, K. Dansk. Vid. Selsk. Skrift. (5) xiii. p. 326.

Genus ECHINOCOTYLE, Blanchard.

E. nitida (Krabbe) in the intestine of the dunlin (*Tringa alpina*).
Krabbe, K. Dansk. Vid. Selsk. Skrift. (5) viii. p. 294.
Clerc, Rev. Suisse Zool. xi. p. 310.

Genus DILEPIS, Weinland.

D. attenuata (Dujard.) in the intestine of the rock-pipit (*Anthus petrosus*).
v. Linstow, Arch. f. Naturg. xli. p. 184.

D. undula (Schrank) in the intestine of the starling (*Sturnus vulgaris*).
Volz, Arch. f. Naturg. lxvi. p. 130.

Genus APLOPARAKSIS, Clerc.

A. filum (Goeze) in the intestine of the dunlin (*Tringa alpina*) and curlew (*Numenius arquata*).
Krabbe, K. Dansk. Vid. Selsk. Skrift. (5) viii. p. 312.
Clerc, Rev. Suisse Zool. xi. p. 257.

A. crassirostris (Krabbe) in the intestine of the ringed plover (*Ægialitis hiaticula*).
Krabbe, *op. cit.* p. 314.
Clerc, *op. cit.* p. 265.

Genus PARACHOANOTÆNIA, Lühe.

P. paradoxa (Rud.) in the intestine of the oyster-catcher (*Hæmatopus ostralegus*).
Clerc, *op. cit.* p. 327.

Genus ANOMOTÆNIA, Cohn.

A. tordæ (Fabr.) [= *Tænia armillaris*, Krabbe] in the intestine of the razor-bill (*Alca torda*).
Krabbe, *op cit.* p. 259.

A. microphallos (Krabbe) in the intestine of the lapwing (*Vanellus vanellus*).
Krabbe, *op. cit.* p. 266.
Clerc, *op. cit.* p. 336.

Order PSEUDOPHYLLIDEA, Carus.

Family **Diphyllobothriidæ**, Lühe.

Genus LIGULA, Bloch.

L. intestinalis (Linn.) in the intestine of the black-headed gull (*Larus ridibundus*).
v. Linstow, Zool. Anz. xxiv. p. 627.
Lühe, Die Süsswasserfauna Deutschlands, xviii. p. 18.

Genus Schistocephalus, Creplin.

S. gasterostei (Fabr.) in the intestine of the black-headed gull (*Larus ridibundus*).
Ariola, Arch. de Parasitol. iii. p. 426.
Lühe, *op. cit.* p. 19.

Genus Diphyllobothrium, Cobbold.

D. dendriticum (Nitzsch) in the intestine of the black-headed gull (*Larus ridibundus*).
Lühe, *op. cit.* p. 21.

(II.) In Fishes.

Order Pseudophyllidea, Carus.

Family **Ptychobothriidæ**, Lühe.

Genus Bothriocephalus, Rud.

B. bipunctatus (Zed.) in the intestine of the bull-head (*Cottus bubalis*), father-lasher (*Cottus scorpius*), turbot (*Bothus maximus*), and halibut (*Hippoglossus vulgaris*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 70; (8) iv. p. 4.

Genus Abothrium (v. Beneden).

A. rugosum (Goeze) in the intestine and pyloric cœca of the haddock (*Gadus æglefinus*) and cod (*Gadus callarias*).
Nicoll, ibid.

A. crassum (Bloch) (=*Bothriocephalus proboscideus*, Rud.) in the intestine of the salmon (*Salmo salar*).
M'Intosh, Journ. Proc. Linn. Soc. Lond., Zool. vii. p. 145.

Order Tetraphyllidea, Carus.

Family **Ichthyotæniidæ**, Ariola.

Genus Ichthyotænia, Lönnberg.

I. longicollis (Zed.) in the intestine of the trout (*Salmo trutta*).
v. Linstow, Jenaische Zeitschr. f. Naturwiss. xxv. p. 565.
Lühe, Die Süsswasserfauna Deutschlands, xviii. p. 31.

Family **Phyllobothriidæ**, Braun.

Scolex polymorphus (Rud.) in the intestine and cœca of the bull-head (*Cottus bubalis*), double-spotted goby (*Gobius ruthensparri*), lump-sucker (*Cyclopterus lumpus*), pogge (*Agonus cataphractus*), dragonet (*Callionymus lyra*), grey gurnard (*Trigla gurnardus*), Montagne's sucker (*Cyclogaster montagui*), catfish (*Anarrhichas lupus*), cod (*Gadus callarias*), smelt (*Osmerus eperlanus*), sprat (*Clupea sprattus*), pipe-fish (*Syngnathus acus*), sand-eel (*Ammodytes tobianus*), three-spined stickleback (*Gasterosteus aculeatus*), halibut (*Hippoglossus vulgaris*), dab (*Pleuronectes limanda*), plaice (*Pleuronectes platessa*), turbot (*Bothus maximus*).

Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 70; (8) iv. p. 4.

Monticelli, Mittheil. Zool. Station, Neapel, viii. (1) p. 85.

Genus Anchistrocephalus, Monticelli.

A. microcephalus (Rud.) in the intestine of the sunfish (*Mola mola*).

Nicoll, Ann. & Mag. Nat. Hist. (8) iv. p. 6.

Order Trypanorhyncha, Diesing.

Genus Tetrarhynchus, Rud.

T. quadrirostris (Goeze) [= *T. appendiculatus*, Rud.] in the intestine of the salmon (*Salmo salar*).

M'Intosh, Journ. Proc. Linn. Soc. Lond. vii. p. 150.

Lühe, Die Süsswasserfauna Deutschlands, xviii. p. 36.

Genus Anthocephalus, Rud.

A. elongatus, Rud., in the liver of the sunfish (*Mola mola*).

Nicoll, Ann. & Mag. Nat. Hist. (8) iv. p. 6.

Pintner, Sitzungsber. kais. Akad. Wissenschaft. Wien. math.-naturw. Kl. cxxii. p. 21.

A. reptans, Wagener. From the muscles of the sunfish.

(C) NEMATODES.

(I.) In Birds.

Family **Ascaridæ**, Cobbold.

Genus Ascaris, Linn.

A. spiculigera, Rud., in the stomach of the black-headed

gull (*Larus ridibundus*), the shag (*Phalacrocorax graculus*), the guillemot (*Uria troile*), and the little auk (*Alle alle*).
Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xvii. p. 31.
Jägerskiöld, Zool. Jahrb. Anat. vii. p. 450.

A. heteroura (Crep.) in the intestine of the golden plover (*Charadrius apricarius*).
Mehlis, Isis (Oken), Leipzig, 1831, p. 90.
Stossich, *op. cit.* p. 33.

A. semiteres (Zed.) in the intestine of the lapwing (*Vanellus vanellus*).
Stossich, *op. cit.* p. 33.
Dujardin, Histoire des Helminthes, p. 200.

Family **Acuariidæ**, Seurat.

Genus Acuaria, Brunser.

A. obvelata (Crep.) in the œsophagus and stomach of the common gull (*Larus canus*).
v. Linstow, Arch. f. Naturg. xliii. p. 174.

A. aculeata (Crep.) in the œsophagus of the dunlin (*Tringa alpina*).
v. Linstow, Arch. f. Naturg. xlii. p. 4.

Family **Trichinellidæ**, Stiles & Hassall.

Genus Capillaria, Zeder.

C. tumida, Zed., in the stomach and cœca of the velvet scoter (*Œdemia fusca*) and the curlew (*Numenius arquata*).
Lühe, Süsswasserfauna Deutschlands, xv. p. 79.

C. totani (v. Linst.) in the intestine of the redshank (*Totanus totanus*).
Lühe, ibid. p. 80.

C. contorta (Crep.) in the intestine of the little auk (*Alle alle*).
Lühe, Süsswasserfauna Deutschlands, xv. p. 79.
Travassos, Mem. Ist. Oswaldo Cruz, vii. p. 146.

(II.) In Fishes.

Family **Ascaridæ**, Cobbold.

Genus Ascaris, Linn.

A. clavata (Rud.) in the stomach and intestine of the haddock (*Gadus æglefinus*), whiting (*Gadus merlangus*), and cod (*Gadus callarias*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 70; (8) iv. p. 4.
Stossich, Atti Soc. Ligust. sc. nat., Genova, 1902, p. 63.

A. collaris, Rud., in the intestine of the halibut (*Hippoglossus vulgaris*), turbot (*Bothus maximus*), brill (*Bothus rhombus*), flounder (*Pleuronectes flesus*), dab (*Pleuronectes limanda*), lemon-dab (*Pleuronectes microcephalus*).
Nicoll, *loc. cit.*
Stossich, Boll. Soc. Adriat. sc. nat. Trieste, xvii. p. 84.

A. angulata, Rud., in the intestine of the bull-head (*Cottus bubalis*), the gunnel (*Centronotus gunnellus*), the three-bearded rockling (*Onos tricirratus*), and the three-spined stickleback (*Gasterosteus aculeatus*).
Nicoll, *loc. cit.*

A. rigida, Rud., in the stomach of the angler (*Lophius piscatorius*).
Cobbold, Trans. Linn. Soc. Lond. xxii. p. 161.
Schneider, Monographie der Nematoden, p. 48, etc.

A. increscens, Molin, in the intestine of the lump-sucker (*Cyclopterus lumpus*), the dragonet (*Callionymus lyra*), and the grey gurnard (*Trigla gurnardus*).
Molin, Denkschr. k. Akad. Wissensch. Wien. math.-nat. Kl. xix. p. 283.

A. adunca, Rud., in the intestine of the smelt (*Osmerus eperlanus*) and sand-eel (*Ammodytes tobianus*).
Lühe, Süsswasserfauna Deutschlands, xv. p. 50.
Stossich, Boll. Soc. Adriat. sc. nat. Trieste, xvii. p. 51.

A. gracilescens, Rud., in the stomach of the sprat (*Clupea sprattus*), v. Linstow, Arch. f. Naturg. li. p. 239; Stossich, *op. cit.* p. 60.

A. capsularia, Rud. (larva), in the peritoneum of the bull-head (*Cottus bubalis*), five-bearded rockling (*Onos mustela*), halibut (*Hippoglossus vulgaris*), dab (*Pleuronectes limanda*), herring (*Clupea harengus*), weever (*Trachinus vipera*), lump-sucker (*Cyclopterus lumpus*), grey gurnard (*Trigla gurnardus*), three-bearded rockling (*Onos tricirratus*), salmon (*Salmo salar*), pogge (*Agonus cataphractus*), sprat (*Clupea sprattus*).
Stossich, *op. cit.* p. 55.
Nicoll, *loc. cit.*

A. communis, Diesing (larva), in the peritoneum of the haddock (*Gadus æglefinus*), cod (*Gadus callarias*), whiting (*Gadus merlangus*).
Stossich, *op. cit.* p. 58.
Nicoll, *loc. cit.*

A. spp. (larvæ) in the peritoneal cavity of the three-spined stickleback (*Gasterosteus aculeatus*), bull-head (*Cottus bubalis*), double-spotted goby (*Gobius ruthensparri*), Montague's sucker (*Cyclogaster montagui*), gunnel (*Centronotus gunnellus*), viviparous blenny (*Enchelyopus viviparus*), sand-eel (*Ammodytes tobianus*), and pipe-fish (*Syngnathus acus*).
Nicoll, *loc. cit.*

Genus Ascarophis, v. Beneden.

A. morrhuæ, v. Ben., in the intestine of the haddock (*Gadus æglefinus*), halibut (*Hippoglossus vulgaris*), and bull-head (*Cottus scorpius*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 92.
v. Beneden, Mém. Acad. roy. sc. Belg. xxxiii. p. 92.

Family **Cucullanidæ**, Cobbold.

Genus Cucullanus, O. F. Müller.

C. cirratus (Müller) [=*Heterakis foveolatus*, Rud.] in the intestine of the haddock (*Gadus æglefinus*), halibut (*Hippoglossus vulgaris*), plaice (*Pleuronectes platessa*), and dragonet (*Callionymus lyra*).
Nicoll, Ann. & Mag. Nat. Hist. (7) xix. p. 70; (8) iv. p. 4.
Schneider, Monographie der Nematoden, p. 68, etc.

Family **Spiruridæ**, Oerley.

Genus SPINITECTUS, Fourm.

S. oviflagellis, Fourm. = *Filaria echinata*, Linst., in the intestine of the whiting (*Gadus merlangus*) and halibut (*Hippoglossus vulgaris*).

Nicoll, *loc. cit.*
v. Linstow, Archiv f. Naturg. xliv. p. 235.
Fourment, Ann. d. sci. nat. Paris, Zool. (6) xvii. art. 5, pl. xvi.

(D) ACANTHOCEPHALA.

(I.) In Birds.

Genus PLAGIORHYNCHUS, Lühe.

P. lanceolatus (Linstow) in the intestine of the dunlin (*Tringa alpina*) and ringed plover (*Ægialitis hiaticula*).

Lühe, Süsswasserfauna Deutschlands, xvi. p. 27.
v. Linstow, Arch. f. Naturg. xlii. p. 2.

(II.) In Fishes.

Genus ECHINORHYNCHUS, Zoega.

E. gadi, Müller (= *E. acus*, Rud.), in the intestine of the bull-head (*Cottus bubalis*), father-lasher (*Cottus scorpius*), Montague's sucker (*Cyclogaster montagui*), viviparous blenny (*Enchelyopus viviparus*), haddock (*Gadus æglefinus*), sand-eel (*Ammodytes tobianus*), three-spined stickleback (*Gasterosteus aculeatus*), three-bearded rockling (*Onos tricirratus*), and five-bearded rockling (*Onos mustela*).

Porta, Arch. Zool., Napoli, ii. p. 171.
Nicoll, *loc. cit.*

Class ANNELIDA.

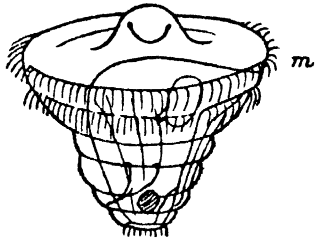
Subclass ARCHIANNELIDA.

Genus POLYGORDIUS.

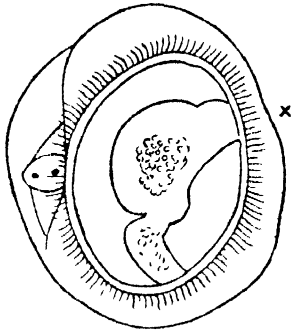
An early *Polygordius* (Lovén †) larva (text-figs. 17–17*f*) was procured in the bottom-net on the 27th July, 1898. The membranous margin is somewhat corrugated from injury

† According to A. Agassiz, Schneider, and Hatschek, the brownish-yellow bodies at the ciliated ring were, perhaps, according to J. W. Fewkes, symbiotic algæ.

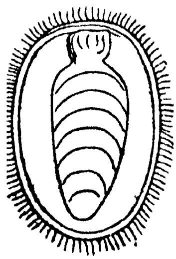
Text-fig. 17.



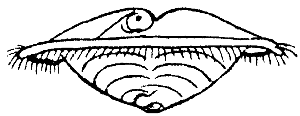
Text-fig. 17 *a*.



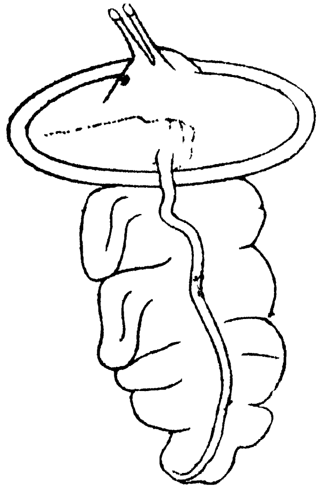
Text-fig. 17 *b*.



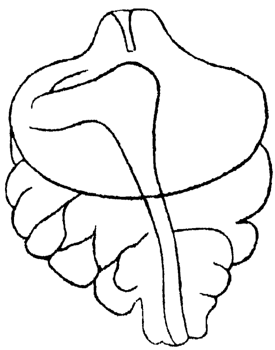
Text-fig 17 *c*.



Text-fig. 17 *d*.



Text-fig. 17 *e*.

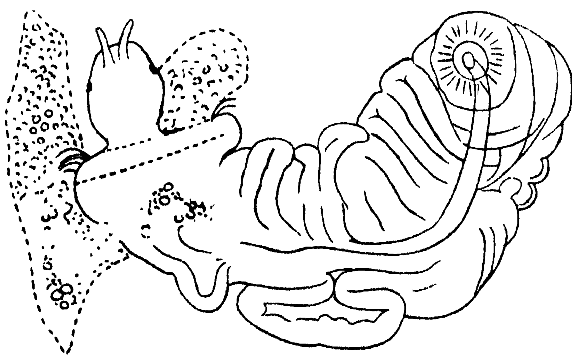


Development of *Polygordius*.

and so with the ciliated band. The head of the *Polygordius* is seen on the right, but no other structure is visible.

Other examples were procured on the 25th July and 28th October, also in the bottom-net. In these the larval form resembled a salver with a jointed mat on it (text-fig. 17 *b*). When seen in lateral view (text-figs. 17 & 17 *c*), the head is on the dorsum, and a pair of eyes and two tentacles are easily distinguished. The tail forms the apex inferiorly. The thin membranous investment of the larva contracts and is minutely veined. A cellular belt lies inside the ciliated ring. The larval mouth (text-fig. 17 *a*) is at the head of the *Polygordius*. When the latter escapes (text-figs. 17 *d*, *e*, *f*) a cloud of the escaped fluid (text-fig. 17 *f*)

Text-fig. 17 *f*.



Development of *Polygordius*.

envelops the head with its two short tentacles and a projecting boss below the mouth. Adhering by the disc-like posterior end it soon swallows sand-grains, wriggling here and there with the anterior end.

No adult form has yet been captured in the Bay ; yet the species swarms amidst the coarse gravel of the Zetlandic shores.

The larva of this species differs considerably from that of *P. neapolitanus* as shown by Fraipont †, both in its earlier and later stages. The head and tentacles are proportionally

† 'Le Genre *Polygordius*,' 1887.

larger, and the body on emergence proportionally thicker. These features, however, may partly, but not altogether, be due to the different stages of emergence.

In all probability *Polygordius* inhabits the Bay, for the larvæ have frequently been met with. If, however, it is usually immersed in gravel or coarse sand at the bottom, it would rarely be disturbed. Whether the species is *P. lacteus*, Schneider, which inhabits the waters of Heligoland, or other North Sea form is at present unknown. Other neighbouring forms are *P. erythrophthalmus*, Giard, from the French coast at Concarneau.

Subclass GEPHYREA.

Amongst the Gephyrea the abundance of *Echiurus vulgaris*, Sav., is a characteristic feature of St. Andrews, certain storms strewing both East and West sands with hundreds, and *Priapulus caudatus*, Lam., is not uncommon. In no British area has *Bonellia* yet been found, but it is frequently met with in the Mediterranean. Moreover, so far as known, the commensalism of *Montacuta* on *Phascolosoma* and *Phascolion* does not occur at St. Andrews, though this happens, as Prof. Pelsener † describes, at Wimereux.

* *Echiurus vulgaris*, Savigny.

An example kept in a tank in the laboratory reproduced the proboscis in January 1886.

In March a peculiar example was obtained in which the perivisceral fluid was brownish, whilst the anterior part of the alimentary canal had a deep red granular coating, and several masses of this were free. The elongated segmental cœca were filled with *ƒ*-shaped clear bodies and considerably less than when distended with the whitish fluid. In colour they were translucent with a reddish granular investment. Thrown on East Sands in numbers on Nov. 28, 1885, along with *Peachia*. Also on January 25, 1886.

Subclass TURBELLARIA.

**Convoluta paradoxa*, Œrsted.

Moving actively amidst *Rhizosolenia*.

† Glanures Biol. Wimereux, Tom. ix. p. 172.

Subclass DISCOPHORA.

A single marine leech (*Pontobdella muricata*, L.) is found at Plymouth, whilst this and another occur at St. Andrews, viz., *Piscicola geometra*, L. Estuary of the Eden on *Cottus bubalis*.

INCERT. SEDIS.

Echinoderes dujardini, Claparède.

Between tide-marks at the Pier Rocks in October.

The Turbellarians of St. Andrews are numerous, but have not been specially studied, only a few of the Planarians having been identified and one or two of the other groups noticed. Some range everywhere in European seas like *Convoluta paradoxa*, Œrsted, and *Leptoplana temellaris*, O. F. M.

The Nemerteans, again, have been subjects of special inquiry, and about twenty species frequent the Bay—some in considerable numbers. At Naples, again, the home of Delle Chiaje and the scene of much recent work on the Nemerteans by Hubrecht and Burger, the list of species in every group is extensive—including almost all the British forms, besides local types.

Order NEMERTINEA.

Malacobdella grossa, O. F. M.

In *Cyprina islandica* and also in *Pholas crispata*, a single example in each.

**Lineus gesserensis*, O. F. Müller.

Ova deposited in March.

Amphiporus hastatus, McI.

A fine example, 3–4 inches long, in a tube of sand and mucus, occurred at the Burn-Stool Rocks. The original form was procured in Shetland.

* *Nemertes carcinophila*, Kölliker.

Mr. Riches †, in his valuable account of the Nemerteans of Plymouth, observes that this form has apparently not

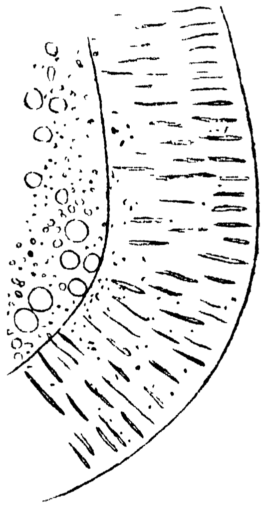
† Journ. Mar. Biol. Assoc. iii. p. 1.

been found on the British shores. This is a misapprehension. The first sentence under *Habitat* refers to Britain, the second to foreign localities †. It is abundant all round our shores on the abdominal hairs of *Carcinus mænas*.

Cerebratulus angulatus, O. F. M. (*C. marginatus*, Renier ?).

Specimens, 11–12 inches in length and half an inch across, were dug out of the East Sands by a fisherman collecting lob-worms on February 23, 1909. The cephalic fissures were deep red and the lateral margins of the body had a band of pink on each side. One on rupture discharged a large quantity of ova.

Text-fig. 18.



Section of pale pelagic form, × 250 diam.

Ciliated forms, somewhat resembling in colour the young of *Alcyonium*, but of a different structure and probably Turbellarians, were encountered on the 15th January, 1898. Externally is a coating of hypoderm under the delicate cuticle, whilst internally is a densely granular mass, like granules of yolk, with spherules of oil. No trichocysts were visible.

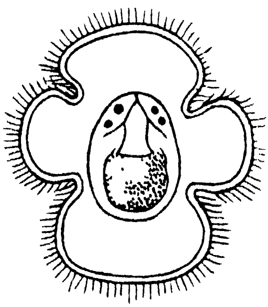
† Monograph, Ray Soc. part i. p. 180

Another paler form of the same date, also richly ciliated, had the hypoderm better defined, and it was crowded with rod-shaped bodies like trichocysts, which escaped externally under pressure. The granules in the interior were coarser and appeared to fill the entire central region (text-fig. 18).

The particular species to which another form belongs is at present unknown. It was pointed anteriorly, and the central region was opaque, with traces of internal differentiation anteriorly (proboscis?). It was procured in the bottom-net of the same date and was richly ciliated.

On the 4th of November, 1897, a small form, which appeared to be a young example of *Carinella annulata*, Montagu, was obtained in the bottom-net. It was of a dull ochreous hue with a slightly broader (spatulate) snout, and also a somewhat enlarged, though rounded, posterior end. Narrow pale transverse belts—five in number—enlivened the body. Under pressure the proboscis was extruded in a corrugated condition.

Text-fig. 19.



Pylidium, magnified.

PYLIDIUM †.

A larval form (text-fig. 19) was procured in the bottom-net, 11th and 27th July, with four broad ciliated lobes, slightly tinged with pink at the margin. In certain lobes the edge seemed to be folded so that the cilia did not show, but the edge was minutely papillose. The central mass was ovoid, with a projecting process at one end. Anteriorly a series of eye-spots occurred, two on each side and a median in front.

† *Vide* Holt, Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 183, pl. xi. fig. 6 (1891).

The shaded part was opaque, viewed laterally it was hat-shaped. It slowly revolved by aid of the cilia, again it swam actively with the long tuft of cilia in front, and revolving as it proceeded, all the cilia (of the two lappets) and the anterior and posterior hood being in full motion.

No known form in the Bay has a *Pylidium*-stage up to date, so that the adult would be an interesting addition. Specimens were obtained by Mr. Holt in the surface-net in October 1890. Others were met with in July 1911 in the bottom-net.

Order POLYCHÆTA†.

The Syllids are conspicuous at South Devon and Plymouth ‡—no less than thirty-eight being found there, whereas at St. Andrews there are only ten. The species *Sphærosyllis, Grubea, Odontosyllis, Trypanosyllis, Procerastea,* and even of *Syllis* and *Autolytus* are either characteristic or surpass in numbers those of the north. All the northern types occur at Plymouth.

Like the Syllidæ the Hesionidæ preponderate at Plymouth, five being present, whilst at St. Andrews only two are found, *Magalia* and *Oxydromus* not occurring there.

No Euphrosynidæ or Amphinomidæ are found at St. Andrews, whereas two of the latter occur at Plymouth. The young of the former have recently been procured in the Irish Sea by Mr. Chadwick.

Two of the Aphroditidæ frequent the south, whilst only one is met with, but occasionally in great numbers, at St. Andrews.

Twenty-two Polynoidæ occur at Plymouth, fifteen at St. Andrews. A characteristic form of the south is *Lepidasthenia argus*, Hodgson.

Sixteen species of Phyllodocidæ are found at Plymouth, though one or two of these are considered varieties, whilst seventeen occur at St. Andrews. Southern forms are *Phyllodoce paretti*, Blainville, *P. rubiginosa,* De St. Joseph, the northern being *P. grœnlandica*, whilst *Eteone picta,* De Quatrefages, and *Mystides* are common to both areas.

† Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 184 (1891).
‡ Journ. Mar. Biol. Assoc. vol. i. p. 68, pl. viii. fig. 1.

Only one species of *Tomopteris* (viz., *T. helgolandica*, Greeff) is mentioned as present at Plymouth, but *T. kefersteini*, Greeff, is also there as at St. Andrews. The former species is *T. catharina*, Gosse, and is widely distributed in the North Sea and around British shores. Comparatively few are found at Naples, though the species vary.

Three species of *Nephthys* characterize Plymouth waters and the same number are found at St. Andrews, *N. cirrosa*, Ehlers, taking the place of *N. johnstoni*, Ehlers, of the north.

The Nereidæ are represented by eleven species at Plymouth and by eight at St. Andrews, the southern *Micronereis*, *Leptonereis*, and *Nereis schmardei* being absent from St. Andrews, which harbours the giant *Nereis* (*Alitta*) *virens*, Sars.

The various groups of the Eunicidæ are represented at Plymouth by three species of *Staurocephalus* (all absent from St. Andrews), by the southern *Ophryotrocha*, by three species of *Lumbriconereis* and *Arabella*, by three species of the Onuphididæ, by two species of *Eunice*, two of *Marphysa*, by *Arabella*, by *Nematonereis* and *Lysidice*. On the other hand, four species of *Lumbriconereis* come from St. Andrews, where no example of the genus *Eunice* and only a single Onuphid, viz., *Hyalinœcia tubicola*, O. F. M., occurs.

Of the Goniadidæ, two species are found at St. Andrews. None are entered for Plymouth.

Five species of *Glycera* frequent the waters of Plymouth. Three occur at St. Andrews, all of which likewise are found in the southern area.

Three species of Ariciidæ are entered for Plymouth, the same forms occurring at St. Andrews, besides two of *Nainereis*.

Three examples of the Opheliidæ (*Ophelia*, *Ammotrypane*, and *Polyophthalmus*) are mentioned as inhabitants of the Plymouth waters, the two former occurring at St. Andrews along with *Travisia*, but not *Polyophthalmus*.

The Scalibregmidæ are represented by two genera (*Eumenia* and *Scalibregma*) at St. Andrews, and by the latter and *Sclerocheilus* at Plymouth.

The Arenicolidæ (Telethusidæ) have three species at Plymouth, whereas only one occurs at St. Andrews, viz., the common *A. marina.*

The Sphærodoridæ are not entered for Plymouth, and a single species is procured at St. Andrews.

Two species of the Chlorœmidæ occur at Plymouth, and the same forms are met with at St. Andrews.

Two species of the Chætopteridæ are found at Plymouth and two at St. Andrews, *C. variopedatus* being present in both localities—*Spiochatopterus* in the north replacing *Phyllochætopterus* of the south.

The Disomidæ (in the family Spionidæ) have but a single species in the respective areas of Plymouth and St. Andrews, only the pelagic larva occurring at the latter.

Fifteen species represent the Spionidæ proper at Plymouth, and about the same number at St. Andrews. Pelagic forms of *Magelona* occur at Plymouth throughout September.

The Cirratulidæ are represented by six species at Plymouth and by three at St. Andrews, at which no species of *Heterocirrus* occurs.

Four species of Capitellidæ frequent Plymouth, whilst only two occur at St. Andrews.

In the family of the Maldanidæ are four species at Plymouth, only three at St. Andrews, and no species is common to both.

Owenia fusiformis, Delle Chiaje, is the only example of the Ammocharidæ at Plymouth. The same form and *Myriochele* occur at St. Andrews. *Mitraria* is said to be rare at Plymouth (Browne). It is more frequent at St. Andrews.

The Hermellidæ are represented by three forms at Plymouth, one of these (*Sabellaria spinulosa,* Leuckart) being the only, but very abundant, species at St. Andrews.

Three species of the Amphictenidæ are found at Plymouth. Two of these occur at St. Andrews, whilst the tube of what

appears to be *Pectinaria belgica*, Pallas (not found at Plymouth), was also dredged off the Bell Rock.

Two species represent the Ampharetidæ at Plymouth, whilst four are found at St. Andrews, *Amphicteis gunneri*, Sars, being common to both.

The Terebellidæ include fourteen species at Plymouth, whilst eight are found at St. Andrews, such southern forms as *Amphitrite edwardsi*, De Quatrefages, *Terebella lapidaria*, L., *Polymnia nebulosa*, Montagu, *Polymnia nesidensis*, Delle Chiaje, *Loimia medusa*, Savigny, being absent from the northern waters.

Thirteen species of Sabellidæ occur at Plymouth, but only six at St. Andrews, the southern types, such as *Potamilla*, *Bispira*, *Amphiglena*, *Jasmineira*, *Oria*, and *Haplobranchus* being absent, whilst *Chone* is present.

Seven Serpulids are entered for Plymouth, viz., five Serpulids proper and two Spirorbids, whereas at St. Andrews the same number and species of Serpulids proper are found and four Spirorbids.

Almost all the British Polychæts are found in the Mediterranean, which, however, harbours in addition such types as *Pontogenia*, *Milnesia*, *Polyodontes*, *Lepidopleurus*, *Euphrosyne*, *Halla*, *Tyrrhena*, *Hydrophanes*, *Asterope*, *Vanadis*, *Telepsavus*, *Ranzania*, *Spirographis*, *Pileolaria*, and *Vermilia*, whilst lacking such types as *Myriochele* and the northern *Sabellaria spinulosa*.

**Lepidonotus squamatus*, L.

Ripe ova occurred in the perivisceral cavity, 22nd February, 1890.

Lagisca elisabethæ, M'Intosh.

Débris of the fishing-boats (*E. M.*).

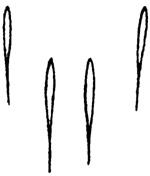
Eunoa nodosa, Sars.

Stomach of cod (*E. M.*).

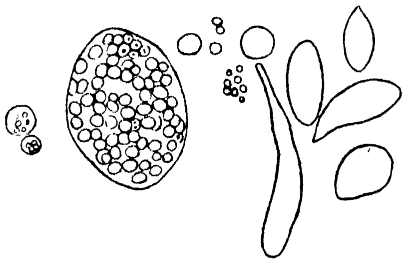
**Harmothoë imbricata*, L.

Ripe sperms (text-fig. 20) were abundant on 31st January, 1890, and the perivisceral fluid is shown on three dates, viz., 8th November, 1892 (text-fig. 20 *a*), 13th December (text-fig. 20 *b*), and 19th January, 1893 (text-fig. 20 *c*). In the

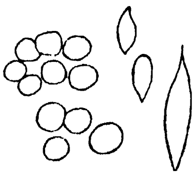
Text-fig. 20.



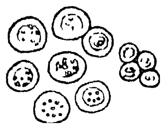
Text-fig. 20 *a*.



Text-fig. 20 *b*.

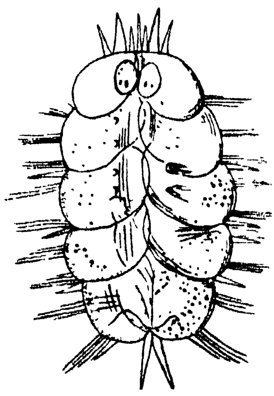


Text-fig. 20 *c*.



Elements in perivisceral fluid of *H. imbricata*, × 350.

Text-fig. 21.



Young *Harmothoë* (pelagic), enlarged.

latter what appear to be developing ova are predominant. Young Polynoids are conspicuous in the bottom tow-nets in the late autumn and end of the year (text-fig. 21).

Harmothoë setosissima, Sav.

West sands after storm (*E. & R. M.*).

**Evarne impar*, Johnston.

Pinkish-white ova in cœlom $\frac{1}{160}$ of an inch in size, 22nd February.

Specimens with ripe ova under the scales were obtained on the 17th February. The masses of ova fell off when the animal was interfered with, though they are more or less held together by a transparent secretion. The zona is delicate, and a perivitelline space is present—since the contained sphere does not fill it, and its surface (sphere) presents here and there elevations In the perivitelline space are a few spherules Most by-and-by divided into two granular spheres.

Young Polynoidæ are very abundant from June to November in the Plankton.

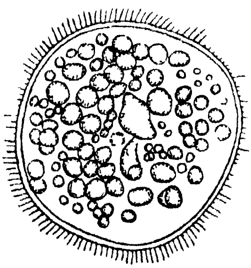
**Halosydna gelatinosa*, Kinberg.

Males with developing sperms in November have a pinkish hue.

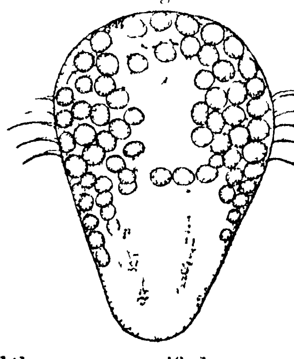
**Pholoe minuta*, Fabr

Males on the 19th June had ripe sperms, with globular heads and long tails.

Text-fig. 22.



Text-fig 23



Egg and early larva of *Nephthys cæca*, magnified.

**Nephthys cæca*, O. Fabr.

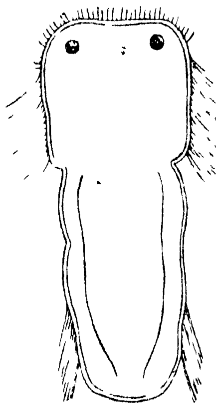
Ova well developed in the cœlom of a female and ·00021 in. in diameter, 15th November.

Text-fig. 22 represents an egg and text-fig. 23 an early larva.

This is a useful species for bait. Thus an example divided into two lived fully six days in sea-water, and when the tail-piece was left dry on the sloping glass plate it wriggled back to the water.

To what family text-fig. 24 belongs is as yet uncertain. It does not agree either with the Nephthydidæ or the Phyllodocidæ †.

Text-fig. 24.



Unknown pelagic larva of Annelid.

Genetyllis citrina, M'Intosh.

Brought up by a fisherman's hook on a stone with a bright yellow sponge and several ascidians.

Genetyllis lutea, Malmgren.

Deep-sea fishing-boats (*E. M.*).

Anaitis rosea. M'Intosh.

East sands near low-water mark.

Eteone spetsbergensis, Mgrn.

West sands after storm.

Mystides lizziæ, M'Intosh.

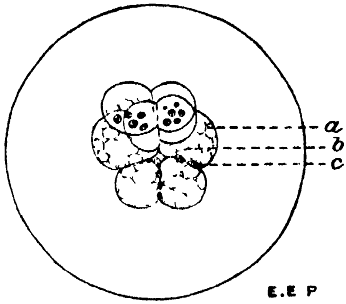
West sands after storm (*E. M.*).

† A note on the pelagic larval Annelids occurs in the Ann. & Mag. Nat. Hist. for August 1890, p. 174.

Tomopteris catharinæ, Gosse.

Abundant throughout the year in the various tow-nets, especially in October. It seems to be rare at Plymouth. An ovum in course of development is shown in text-fig. 25.

Text-fig. 25.



Early ovum of *Tomopteris catharinæ*, magnified.

Tomopteris kefersteini, Greeff.

Accompanying the former throughout the year. It feeds on its own species, and Dr. Lebour found it devoured *Sagitta* and young herrings.

Peculiar pelagic Syllid (*Autolytus*) near, but different from, *Ioida* (Monograph, vol. ii. pt. i. p. 112, fig. 45).

Exogone gemmifera, Pagenstecher.

Under a stone, East Rocks, id. p. 151, pl. lix. figs. 5 & 6.

Syllis cornuta, H. Rathke.

Débris in deep-sea fishing-boats (*E. M.*).

Syllis gracilis, Grube.

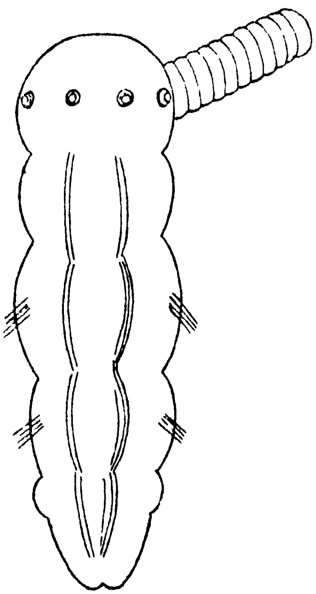
Débris in deep-sea fishing-boats (*E. M.*).

**Autolytus prolifer*, O. F. M.

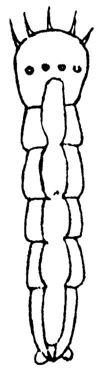
The young of *Autolytus prolifer* on the 9th May have increased in size (text-fig. 26). The head does not present the palpocils it formerly had, and the four brownish eyes are still nearly in a transverse line, the two median being

dorsal, each of the lateral being so near the margin that oblique vision downward is possible. Four segments follow the head, the buccal marked by the extruded proboscis and somewhat shorter than that which follows, which is provided with the somewhat rudimentary but typical bristles of the group with the bifid tips ; the third body-segment is shorter, but has similar bristles ; the antepenultimate segment is short and smooth, and the anal slightly tapers to a blunt anus. The animal is evidently feeding, for the digestive canal is largely distended in front with granules, and it swims about. Seventeen days afterwards the head presented a process (tentacle) with a palpocil, the two feet bearing the

Text-fig. 26.



Text-fig. 27.



Text-fig. 26.—Young *Autolytus*.
Text-fig. 27.—Early stage of *Autolytus*.

bristles were better developed, being elongated dorsally and having a shorter thicker ventral region.

An earlier stage with palpocils, but without bristles, is shown in text-fig. 27.

**Nereis pelagica*, L.

In the epitokous form the posterior feet are moved rhythmically at slight intervals.

**Nereis diversicolor*, O. F. M.†.

No viviparity observed at St. Andrews and no epitokous forms seen.

Lumbriconereis gracilis, Ehlers.

Stomachs of cod and haddock (*E. M.*).

Lumbriconereis latreillii, Aud. & Ed.

Débris of deep-sea fishing-boats and in the stomach of flounders (*E. M.*).

Lumbriconereis impatiens, Claparède.

Deep water off the Bay and in the stomach of the flounder (*E. M.*).

Lumbriconereis (*Zygolobus*) *laurentianus*, Grube.

Stomachs of cod and haddock (*E. M.*).

Drilonereis longa, Webster.

Stomachs of cod and haddock (*E. M.*).

**Goniada maculata*, Œrst.

Also in sand near low-water mark at the entrance to the harbour.

Eone nordmanni, Mgrn.

Stomachs of cod and flounder (*E. M.*).

Glycera alba, H. Rathke.

Beyond low-water mark and in stomachs of haddock and flounders (*E. M.*).

Aricia latreilli, Audouin & Edwards.

Sandy shore and beyond low-water mark. The long-spined larva (text-fig. 30) may belong to this family.

Nainereis spec. I.

On West Sands after storms.

Nainereis spec. II.

On West Sands after storms.

† *Vide* Ann. & Mag. Nat. Hist., Sept. 1907.

Scalibregma inflatum, H. Rathke.

Deep-sea fishing off the Bay.

**Arenicola marina*, L.

Ripe spermatozoa in cœlom, 18th January. Where there is no current little mounds of sand mark the haunts of this species. The larva shown in text-fig. 24 somewhat resembles a young *Arenicola*.

Claparède's Larval "Spio."

Occurs in July and October with white pigment at the sides. Apparently not a Spionid (see Beobacht. Taf. vi.). Bottom-net.

Family **Chætopteridæ.**

In October a larval form (text-fig. 29 *a*) about 2 mm. long was obtained in the bottom-net with a broad scoop-shaped anterior region and a bilobed under-lip, the colour of the body being slightly pinkish. Two bands of powerful cilia occurred behind the middle (*a* and *b*), and two eyes were present on each side. The body narrowed somewhat abruptly posteriorly, and had two pigment-spots at the base of the caudal region, whilst the rectum showed active muscular contractions of its walls.

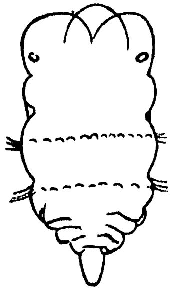
Another larva having only two eyes, but with a similar outline anteriorly, was obtained the same month (text-fig. 28). The two ciliated bands and the lobed posterior region are present with a caudal process. Reddish-brown pigment occurred anteriorly and posteriorly. In contrasting these figures the caudal process in text-fig. 28 and text-fig. 29 *a* is shorter than in text-fig. 29 *b*, and the lobed region posteriorly is less distinct.

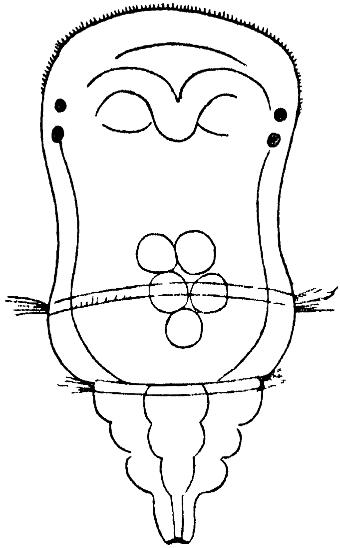
So far as known, only two Chætopterids are met with in the Bay, viz. *Chætopterus variopedatus* and *Spiochætopterus*. The former has hitherto been procured in the stomach of the cod, whilst the tubes alone of the latter have been dredged. The occurrence, therefore, of a larval Chætopterid is of interest, and it cannot readily be confounded with that of any other Annelid. J. Müller † first described the larva

† Archiv f. Anat. u. Physiol. 1846, p. 104, Taf. v. figs. 3, 4, 5.

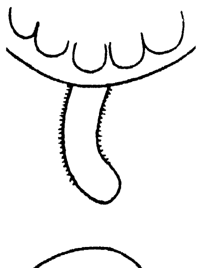
Text-fig. 29 *a*.

Text-fig. 28.





Text-fig. 29 *b*.



Text-fig. 29 *c*.

Text-fig. 28.—Early Chætopterid larva with two eyes.
Text-fig. 29 *a*.—Later larva with four eyes.
Text-fig. 29 *b*.—Posterior end of Chætopterid larva with lobed region in front.
Text-fig. 29 *c*.—Snout of larva with two eyes.

from Heligoland under the name of *Mesotrocha sexoculata*, and his figures are accurate and easily recognized, being of a somewhat later stage than that represented in our text-fig. 29*b*, and differing therefrom in the presence of two anterior eyes as well as the two pairs of lateral eyes. The general outline of the body and the conformation of the tail and the two bands of cilia are similar, but the segmentation anteriorly and posteriorly is more definite. He shows six rings in the diminishing caudal region and the central tail. The rings of cilia have a gap on the ventral surface. The proper position of the animal was unknown to Müller.

The next author who took up the subject of the *Mesotrocha sexoculata* was Busch †, a pupil of the former master. He found at Trieste two stages of *Mesotrocha*, though he thought them different, referring the younger to the Sars-Lovén type of larva. His figures of the latter, however, are not quite accurate, especially anteriorly and posteriorly, but they probably refer to the same form. His stages of *Mesotrocha* are more advanced than Müller's both in regard to segmentation and bristles.

The next observer was Max Müller ‡, the son of Joannes Müller, who placed the foregoing larva amongst the Chætopteridæ, but his figures are deficient in detail.

Without going into minute historical detail, it may briefly be mentioned that the important memoir by Claparède and Mecznikow § added much to our knowledge of the group, though they did not treat of the same species, the forms dealt with at Naples being *Telepsavus costarum*, Clap., and *Phyllochætopterus socialis*, Clap. The five figures of the authors, as well as their descriptions, are noteworthy.

J. W. Fewkes ‖ in 1883 described the larva of *Telepsavus* as having only two eyes, and an outline not unlike the St. Andrews form. He shows that the young *Phyllochætopterus* has six eye-spots and a long ciliary tuft in front, and a shorter tail. E. B. Wilson ¶ also alludes to the larva of *C. pergamentaceus*, one being twelve days old with two eyes and a short tail.

Béraneck **, again, gives an account of a similar form to

† Beobach. ü. Anat. u. Entwickelung. Wirb. Seeth. p. 59, Taf. ix. figs. 1–10.

‡ Observ. Anat. de vermibus Marit. 1852, p. 25, Taf. iii. figs. 15–17.

§ Zeitschr. f. w. Zool. xix. Bd. p. 178, Taf. xiv. figs. 1 & 2 (1869).

‖ Bull. Mus. Comp. Zool. vol. xi. p. 177.

¶ Martin and Brooks, Studies from the Biol. Lab., Johns Hopkins Univ., Baltimore.

** 'Revue Suisse de Zoologie, &c.,' tome ii. fasc. 3, 1894, pl. xv.

that of Müller's which he obtained at Villefranche-sur-Mer, and which he thought was the larva of *Chætopterus variopedatus.* His earliest stage was more advanced than the oldest specimen from St. Andrews, and he reared it till the features of the genus were observable. His earliest form had the anterior pair of eyes in addition to the pair of lateral eyes.

An advanced mesotrochophore is shown in pl. xi. fig. 9 of the 'Marine Plankton' by Prof. Johnstone and Messrs. Scott and Chadwick.

The larval and young examples of *Chætopterus* are more common in the warmer waters of the Irish Sea and the south than in the north. In the Channel Islands the adult is not uncommon between tide-marks. In the Irish Sea Mr. Chadwick of Port Erin mentions that he finds early stages of the larva in the last week of June and the later stages towards the end of July. He has not yet recognized the trochophore stage, but the active metatrochophore is easily observed.

Genus Spiochætopterus.

Tubes occasionally dredged off the Bay and brought by the fishing-boats (*E. M.*).

Family Spionidæ.

Nerine cirratulus, D. Chiaje.

East and West Sands after storms (*E. M.*).

Scolicolepis fuliginosus, Claparède.

Débris of fishing-boats (*E. M.*).

Spio filicornis, O. Fabr.

Swarms near low-water mark.

Spio, D.

Débris of fishing-boats (*E. M.*).

Spio, G.

Débris of fishing-boats (*E. M.*).

**Polydora ciliata*, Johnston.

Ripe sperms in June and probably before and after.

Polydora flava, Claparède.

In the chinks of the East Rocks along with *Pygospio.*

Polydora caulleryi, Mesnil.

In the shale at the Castle Rocks.

Polydora hopleura, Claparède.

In shale at the Castle Rocks.

Spiophanes bombyx, Clap.

Not uncommon in sand near the East Rocks at low water.

Pygospio elegans, Clap.

Abundant in sandy tubes in fissures of the East Rocks.

**Magelona papillicornis*, F. Müller.

Ova greatly developed in November. Many young forms caught in the nets in June and July †.

1891, Oct. 20.—A large number of ova escaped from the ruptured body (pl. ii. fig. 57).

Young *Magelonæ* are found of larval mollusks (*Lebour*). J. W. Fewkes ‡ described what is apparently this form as *Prionospio tenuis*, Verrill.

PŒCILOCHETUS-larva.

Occurs in tow-nets from June till October. No adult seen.

A characteristic long-spined Spionid larva is figured from the tow-net in July by Mr. Pentland Smith, B.Sc. (text-fig. 60) with its spinous bristles.

Cirratulus tentaculatus, Montagu.

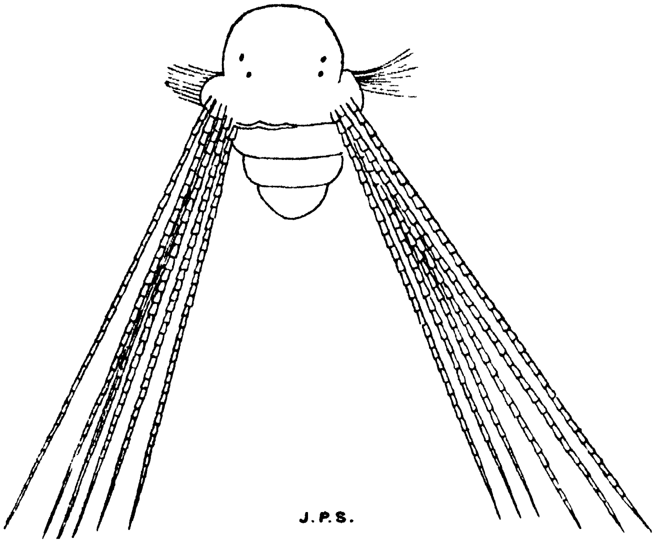
Abundant under stones near low-water mark.

Notomastus latericeus, Sars.

Tossed in numbers on the West Sands after storms (*E. M.*).

† *Vide* Quart. Journ. Micros. Sc., 10th May, 1894.
‡ Bull. Mus. Comp. Zool. vol. xi. pl. i.

Text-fig. 30.

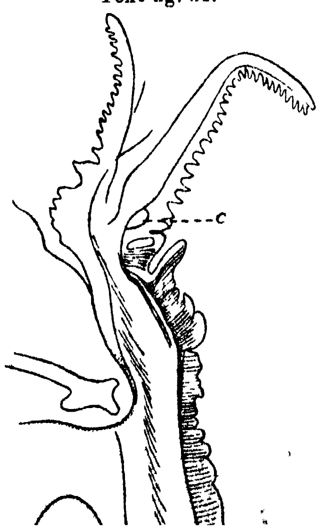


Spionid larva.

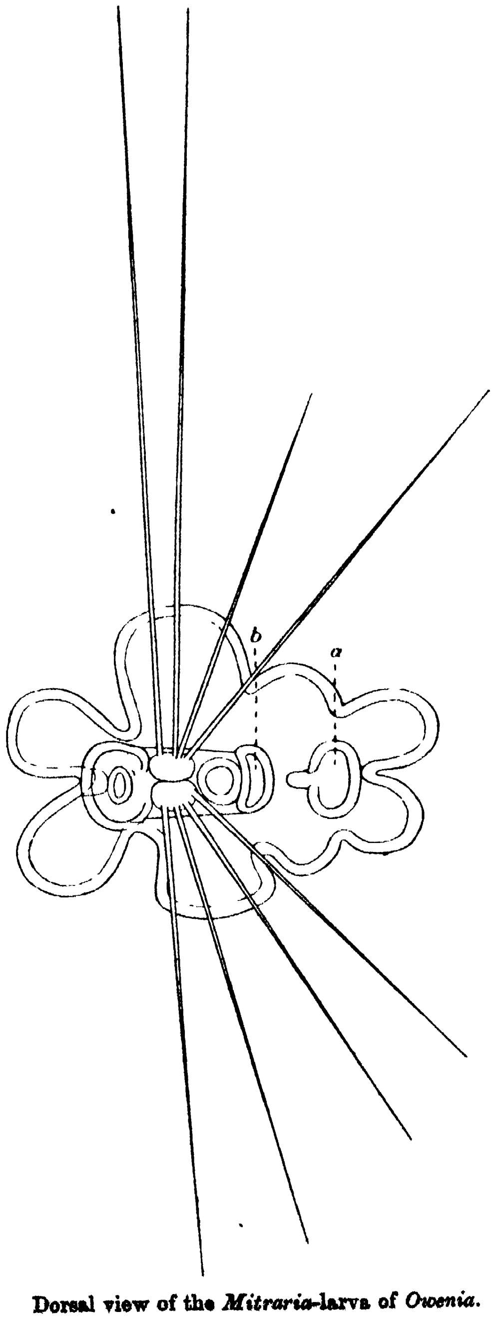
**Owenia filiformis*, D. Chiaje. (Text-figs. 32 and 32 *a*.)

A vertical section (text-fig. 31) of the anterior end shows the brain (*c*) and the adjacent pigment.

Text-fig. 31.



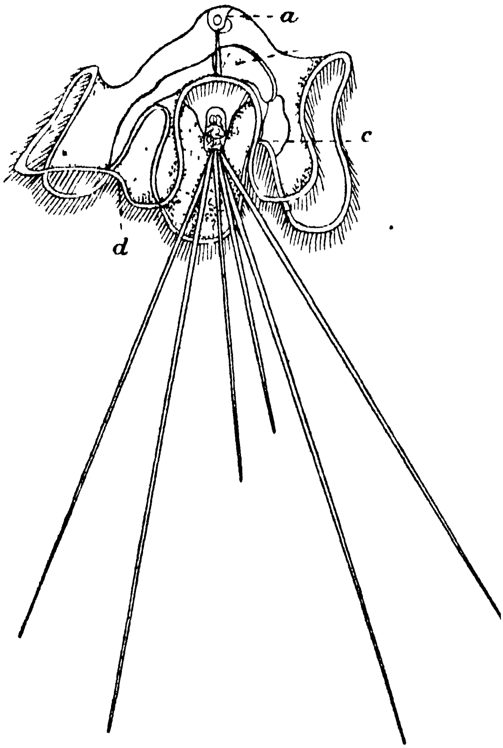
Text-fig. 32.



Dorsal view of the *Mitraria*-larva of *Owenia*.

The *Mitraria*-larva is met with in July and is a striking form (text-fig. 32). It has six lappets or lobes, besides the frilled arches between them, and by adjustment of the light its arch or cone, as well as the tissue of the lobes, is found to be reticulated. No cilia occur on the edges, the triradiate mouth alone showing active ciliation, and it has an open channel between two of the front lobes.

Text-fig. 32 *a*.



Lateral view of the *Mitraria*-larva.

Though cilia in motion are absent from the lobes, their thick edges have a dense coating of straight palpocils resembling motionless cilia. The long bristles spring from a central mass behind the mouth, are bilaterally arranged, and are jerked in various directions, often being spread out and again bent inward. Two on each side are very long, three or four times the long diameter of the animal, besides numerous

shorter ones, and they appear to be furnished with minute prickles. The stomach is minutely granular as if from glands, its cavity is capacious, and its walls somewhat thick. In front of the bristles is a folded region, but whether it represents a vent is uncertain. The body is colourless or with a slight opacity of the thick part of the lobes, and, as it moves forward with the mouth in front, the long bristles sparkle with the most gorgeous iridescence, a deep rich lapis lazuli blue, or occasionally a lustrous green being especially conspicuous—and often in interrupted touches, as if the bristle were undulating. The effect of the groups of bristles was striking, since the colours disappeared during the motions of the animal and again flashed into full beauty—like alternating phosphorescence. The fine bluish iridescence even remained next day after killing with corosive sublimate and preservation in spirit. E. T. Browne † finds this form rare on the southern shores of England.

The earlier zoologists who examined *Mitraria* were Claparède, J. Müller, Schneider, and Metschnikoff. All contributed to the elucidation of its structure and relationships, especially the latter. The species has a wide distribution in European waters.

Prof. Allman ‡, who examined the form at Spezzia, described the supra-œsophageal ganglion as sending off a branch on each side to a small ganglion on opposite sides of the stomach, and the ocelli as furnished with lenses, whilst there are two auditory vesicles. A vascular sinus surrounds the apical ganglion. In development the aboral end of the alimentary canal becomes elongated as does the body of the worm, and segmentation follows. Both dorsal and ventral walls of the body are formed simultaneously, whereas Metschnikoff considered the dorsal appeared first.

In the ventral view of the *Mitraria* (text-fig. 32) the region from which the young annelid is developed is marked *b*.

Myriochele heeri, Mgrn.

Stomach of haddock (*E. M.*).

**Pectinaria belgica,* Pallas.

Large tube off the Bell Rock.

† Journ. Mar. Biol. Assoc. iv. p. 171.
‡ Quart. Journ. Micr. Sc. vol. xii. 1872.

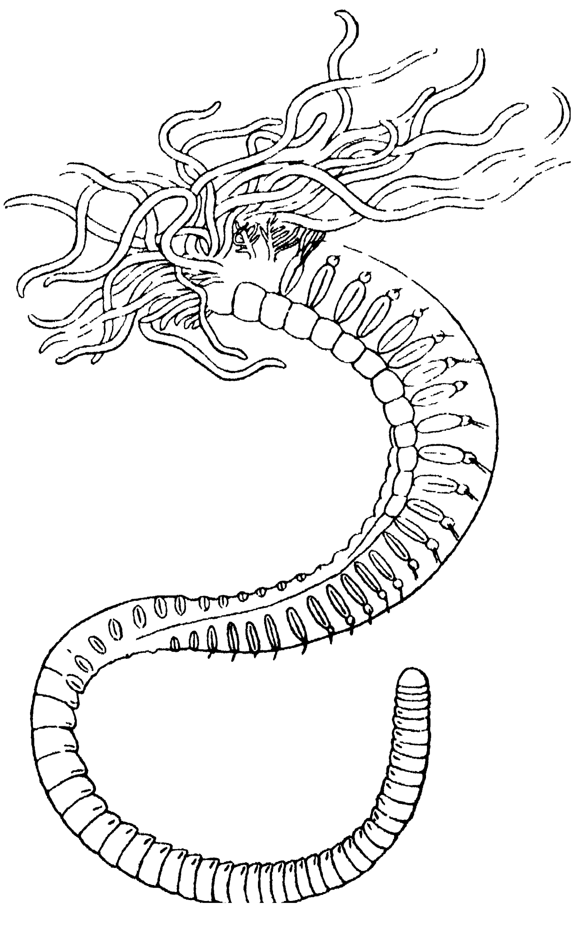
Lagis koreni, Mgrn.

Abundant in the sand beyond low-water mark and in the stomachs of plaice and flounders (*E. M.*). The pelagic young are frequent in June.

Ampharete acutiforons, Grube.

Large examples in the stomachs of cod and haddock (*E. M.*).

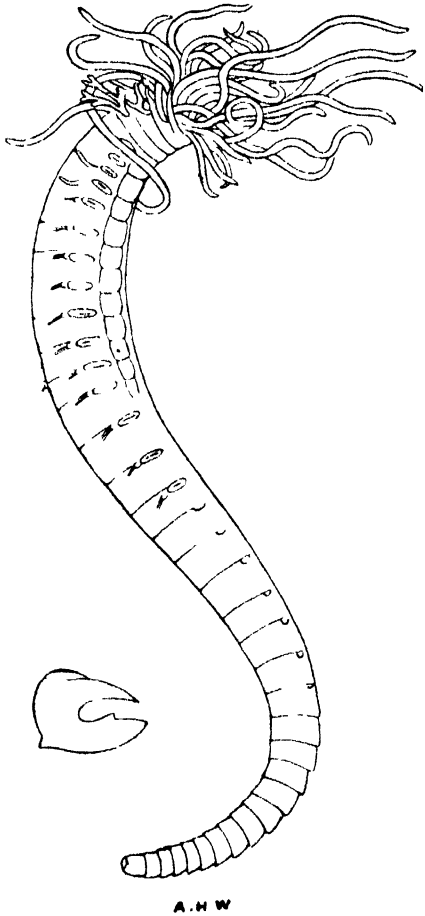
Text-fig. 33.



Amphitrite figulus, Dalyell.

Melinna elizabethæ, M'I.
Stomachs of haddock and flounders (*E. M.*).

Text-fig. 34.



Nicolea venustula, Montagu.

Amphitrite cirrata, O. F. M.
Under stones at the East Rocks (*R. M.*).

**Amphitrite figulus*, Dalyell. (Text-fig. 33.)
Under stones on sand near low-water, and in débris of the fishing-boats from deep water.

**Nicolea venustula*, Montagu. (Text-fig. 34.)

Those with longer stalks to the branchiæ come from fishermen's lines off the Bay, West Sands and Rocks, and Pier Rocks.

Polycirrus medusa, Grube.

Occasionally in fissures between the layers of the East Rocks.

Polycirrus hæmatodes, Claparède.

Débris of fishing-boats (*E. M.*).

Terebellides strœmi, Sars.

Stomach of haddock (*E. M.*).

Myxicola infundibulum, Montagu.

Occasionally dredged in the deeper water of the Bay.

**Myxicola viridis*, Milne-Edwards.

Dredged off the Bell Rock as *Sabella viridis*.

**Dasychone argus*, Sars. (Text-fig. 35.)

Not uncommon in the deeper water.

Chone fauveli, M'Intosh.

West Sands after storms and deep sea.

**Fabricia sabella*, Ehrenberg.

Abundant near low-water mark, East Rocks, adhering to *Styelopsis granularia* (*E. M.*).

Spirorbis spirillum, L.

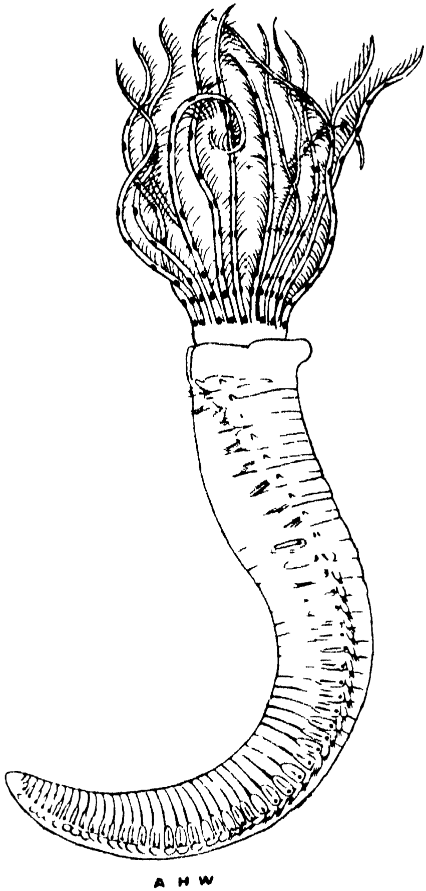
Abundant on zoophytes in the Bay.

Spirorbis granulatus, L.

Common on stones in tide-pools.

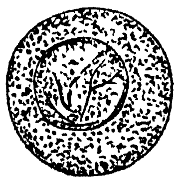
In the tow-net on 1st July, 1903, a minute whitish egg (text-fig. 36) occurred, and which, when compressed, burst, disclosing an inner body (nucleus) with a distinct capsule,

Text-fig. 35.



Dasychone argus, Sars.

Text-fig. 36.



Unknown pelagic egg.

which showed wrinkles when compressed. The inner body resembled a Crustacean egg, though it may pertain to another group.

A peculiar pea-shaped body was got in the surface-net, 23rd July, 1903. From the small end of the pea passes off a finished process separated into a basal and a distal region by a central dilatation. The basal region dilates very slightly and then contracts near the body of the structure. The distal region tapers from the dilatation to a fine point. No movement was observed. The lower end of the process is differentiated from the gelatinous body. The latter appears to have an adhesive surface, since sand-granules and various minute structures (algæ etc.) adhere. Under a power of 100, active movements of minute rod-shaped bodies were observed all over the mass, apparently internally. Whether these were spermatozoa in a gelatinous case is unknown, but it may be. They were perfectly quiescent in the water. When fresh water was added the pea-shaped body shrank a little.

[To be continued.]

V.—*A new Species of* Miridæ *from the South-east Pacific.* By L. Evelyn Cheesman, F.E.S., F.Z.S.

Cyrtorrhinus riveti, sp. n.

♂. Shining black; sparsely and irregularly covered with long, whitish, subdepressed hairs, less sparsely on the hemelytra. A large spot on each side of the vertex touching the inner margin of the eyes; antenniferous tubercles, margins of bucculæ, extreme base and apex of first antennal segment, rostrum, hemelytra, a broad longitudinal fascia in the centre of the abdomen reaching to the base of the sixth apparent segment, and legs creamy-white. Apices of femora, tibiæ, and tarsi suffused with pale creamy-brown. Abdomen laterally and apically castaneous.

Head seen from above much broader than long; seen from the side, height at the base equal to the length. Antennæ clothed in short light brown pilosity; first segment reaching for half its length beyond the apex of the head; length of segments beginning with the first 18–54: (65=1 mm.), apical segments missing. Rostrum reaching the apex of the posterior coxæ. Pronotum transverse; length just over two-fifths of the breadth at the base, which is almost twice the

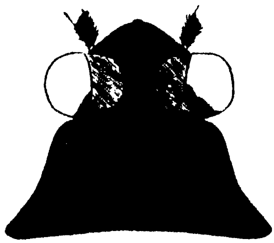
breadth at the apical margin (see fig.); disc flat, with indistinct calli anteriorly.

Length 2 mm., breadth 0·8 mm.

♀. Similar in coloration.

Length of antennal segments 18–50–38–33 (65=1 mm.).

1 ♂, 1 ♀, B.M. Coll. Tahiti, Society Islands, April 1925 (*L. E. Cheesman*). Taken among *Tradescantia* at the borders of streams, sea-level.



Cyrtorrhinus riveti, sp. n.

Closely allied to *C. parviceps*, Reuter, but a more slender and elongate species, the pronotum entirely black, the relative lengths of first and second segments different (14–43 in *C. parviceps*).

I have the honour of dedicating this charming little Capsid to Monsieur Rivet, Governor of the French Possessions in the Pacific.

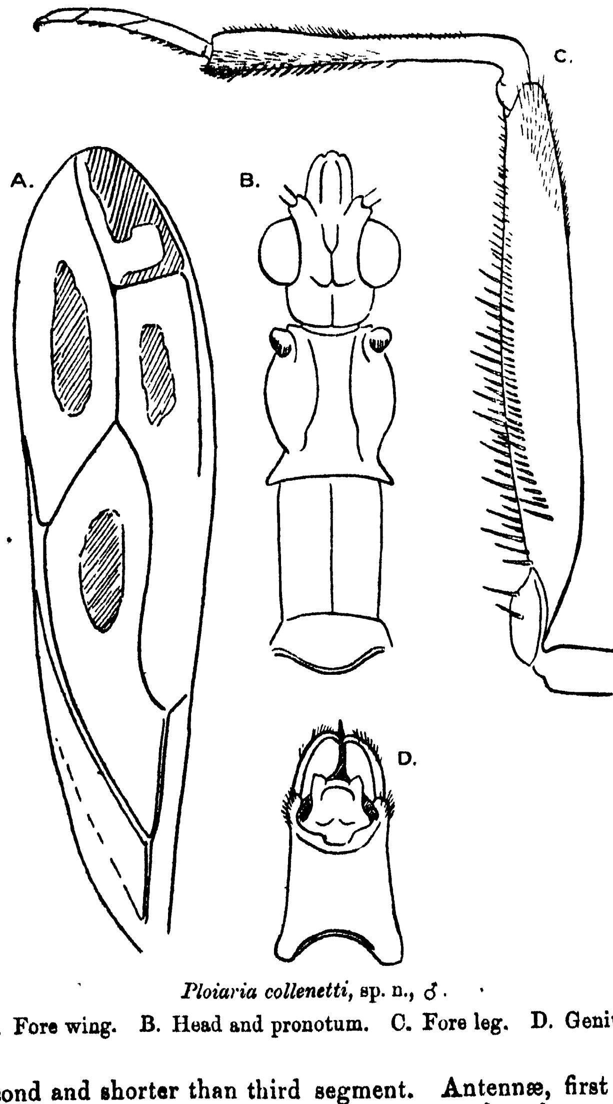
VI.—*A new Species of* Reduviidæ *from the South-east Pacific.* By L. Evelyn Cheesman, F.E.S., F.Z.S.

Ploiaria collenetti, sp. n.

♂ matt. Light fulvous-brown suffused and indistinctly marked with fuscous; the pronotum with two broad lateral fuscous fasciæ. Head sparsely covered with minute depressed light brown hairs, base of basal lobe fuscous. Mesonotum fuscous-brown, lateral carinæ fulvous-brown. Scutellum dark brown. Antennæ dark brown, base of first segment fulvous-brown. Legs pale brown. Abdomen fuscous-brown.

Head without spines; seen from above, width below the eyes just over half the length. Tylus evident from the side,

a trifle longer than the juga. Head seen from the side, height rather more than half the length. Eyes touching the base of the antennæ. Rostrum, first segment subequal to



Ploiaria collenetti, sp. n., ♂.

A. Fore wing. B. Head and pronotum. C. Fore leg. D. Genitalia.

second and shorter than third segment. Antennæ, first segment nearly six times the length of the head and pronotum together, second segment more than three-quarters the length

of first (third segment imperfect). Pronotum constricted before the posterior margin, the sides strongly convex; posterior lateral margin of the prosternum beneath the eye distinctly elevated into a bilobed prominence. Apparent posterior margin of the prosternum seen from below entire. Apical vein of fore wing almost two-thirds the length of the discal cell (fig. A). Fore trochanters not spined, each with two long bristles (fig. C). The combined length of the fore tibiæ and tarsi distinctly less than that of the femora. Both sexes winged.

♂ genitalia figured.

Length 5 mm.

3 ♂, 3 ♀, B.M. Coll. Fatu-hiva, Marquesas Islands. Taken behind bark by Mr. Collenette, May 1925 ('St. George' Expedition).

In *Ploiaria domestica*, the genotype of *Ploiaria*, the fore trochanter is produced into a strong spine, whereas in *P. collenetti* it is only armed with two bristles. In spite of this difference, I have followed McAtee and Malloch, who in their key (Phil. Journ. Sci. vol. xxx. no. 1, 1926) have included both these types of armature in their subgenus *Ploiaria*. It appears more probable, however, that species in which the fore trochanter is not produced into a spine but bears bristles (as in *P. collenetti*) are more closely related to *Luteva* than to *Ploiaria*.

VII.—*Papers on Oriental* Carabidæ.—XIX.
By H. E. Andrewes.

During a short visit recently paid to Berlin, I had the opportunity of examining in the collection of the Zoological Museum the types of a number of authors, including Herbst, Klug, Erichson, Schaum, and Nietner, and I desire here to express my indebtedness to Dr. Kuntzen, who expended much time and trouble in assisting me, and in searching for the various specimens I was anxious to see. In regard to Nietner I shall refer also to the collection of Ceylon specimens which Dr. Schröder of the Stettin Museum was good enough to send me for examination two or three years ago. I have also to thank Dr. Horn for allowing me to see the New Guinea types of Mr. T. G. Sloane in the Museum of the Deutsch. Ent. Institut at Dahlem.

The following notes record such instances of synonymy

as I discovered, and state which types were found and which were missing. The synonymy is given in all cases, an asterisk being used where it is recorded here for the first time, and placed against the older name. References to the genus *Tachys* have been omitted, as they were dealt with last year in my Revision of the Oriental species. None of the authors in question designated a specimen as "type," so that the word as here used means a historical specimen, usually labelled by the author, which may reasonably be regarded as the equivalent of a modern type. The various authors are referred to in approximately chronological order.

J. F. W. Herbst.

1. *Calosoma* (*Carabus*) *auropunctatum* (Fuessly's Archiv, v. ii. 1784, p. 131). Type missing, but there seems no reason to doubt that the traditional identification of this well-known palæarctic species is correct.

2. *Chlænius* (*Carabus*) *cinctus* (ibid. p. 135, t. xxix. fig. 7).

This professed to be a redescription of the Fabrician species, but the specimen is missing, and, with nothing but the description, it is impossible to decide whether or not the identification is correct.

3. *Carabus indicus* (ibid. p. 138, t. xxix. fig. 11). Type missing.

Chaudoir (Bull. Mosc. 1852, i. p. 67) identified the species with *Diplocheila* (*Rembus*) *polita*, Dej. (not F.) (Spec. Gen. ii. 1826, p. 381), but gave no reason for holding this view, and it seems better, therefore, to rule the name out.

4. *Siagona* (*Scarites*) *tomentosa* (Nat. Syst. Ins. Käf. x. 1806, p 260, t. clxxv. fig. 12)=*Siagona depressa*, F.* (Suppl. Ent. Syst. 1798, p. 56). Type at Berlin.

5. *Clivina* (*Scarites*) *attenuata* (ibid. p. 264, t. clxxvi. fig. 7 *e*). Type at Berlin.

Redescribed by Bonelli as *C. picipes*, and by Putzeys as *C. metanaria* (see Putzeys' Monograph, Postscript, and Revision).

6. *Scarites unicolor* (ibid. p. 265, t. clxxvi. fig. 9 *g*). Type missing.

Probably a *Clivina*, but the species is unrecognizable.

P. Rossi.

1. *Zuphium* (*Carabus*) *olens* (Faun. Etrusc. i. 1790, p. 217, t. v. fig. 2). Type at Berlin.

In the type the two shoulder-spots are very large and practically cover the front half of the elytra.

2. *Chlænius* (*Carabus*) *spoliatus* (ibid. Mant. 1792, p. 79). Type at Berlin.

G. W. F. Panzer.

1. *Ophonus* (*Carabus*) *griseus* (Faun. Germ. 1797, 38, i.). Type at Berlin.

J. C. W. Illiger.

1. *Omphra* (*Carabus*) *rufitarsis* (Mag. Ins. 1802, pp. 164 & 490) = *Omphra hirta*, F. (Syst. Eleuth. i. 1801, p. 214). Type at Berlin.

J. Sturm.

1. *Harpalus lævistriatus* * (Deutschl. Faun. Ins. iv. 1818, p. 80, t. xci. fig. B) = *Gnathaphanus orientalis*, Dej. (Spec. Gen. iv. 1829, p. 128) = *G. acutipennis*, Bates (Ann. Mus. Civ. Gen. 1892, p. 328). Type at Berlin.

Sturm's name being older must replace Dejean's.

C. Zimmermann.

1. *Æphnidius* (*Masoreus*) *opaculus* (Gistl's Faunus, i. 1832, p. 120). Type at Berlin.

I am convinced that this species is identical with *A. simplex*, Schm. Goeb. (Faun. Col. Birm. 1846, p. 89), but unfortunately I took no specimen with me for comparison.

2. *Æphnidius* (*Masoreus*) *pleuronectes* (ibid. p. 120). Type at Berlin.

3. *Æphnidius* (*Masoreus*) *sericeus* (ibid. p. 121) = *Æ. adelioides*, Macl.* (Ann. Jav. 1825, p. 23, t. i. fig. 7). Type in Berlin.

Schaum seems first to have suggested this synonymy (Berl. Ent. Zeitschr. 1863, p. 78), but Chaudoir did not accept his suggestion (Bull. Mosc. 1876, iii. p. 17).

4. *Masoreus grandis* (ibid. p. 121).

This specimen, which bears a locality-label "Abyss.

Ehrbg." and the number 816, has no name of genus or species attached, but it is indicated as the type, and there seems no reason to doubt this. Gemminger and Harold, and others following them, put the species in synonymy with *M. orientalis*, Dej. (Spec. Gen. iii. 1828, p. 539). The specimen, which I compared with an Indian example of *orientalis*, is larger, wider, and more finely striate; like Schaum (Berl. Ent. Zeitschr. 1863, p. 77) I regard it as a distinct species.

F. Klug.

With two exceptions, I saw the types of all the undermentioned species at the Zoological Museum:—

1. *Trichis pallida* (Symb. Phys. Decas iii. 1832, t. xxi. fig. 9).

2. *Trichis maculata* (ibid. t. xxi. fig. 10).

3. *Glycia* (*Cymindis*) *ornata* (ibid. t. xxii. fig. 3). I did not see this type, but have no reason to doubt that it is at Berlin.

4. *Scarites exasperatus* (ibid. t. xxiii. fig. 4) = *S. eurytus*, Fisch. (Ent. Russ. iii. 1828, p. 119, t. v. fig. 3).

The species has also been redescribed by various later writers and the synonymy is well known.

5. *Calosoma imbricatum* (ibid. t. xxiii. fig. 11).

6. *Desera* (*Drypta*) *geniculata* (Jahrb. Ins. 1834, p. 52).

7. *Desera* (*Drypta*) *cœlestina* (ibid. p. 53).

Chaudoir (Bull. Mosc. 1861, ii. p. 545) appears first to have put this species in synonymy with *D. unidentata*, Macl. (Ann. Jav. 1825, p. 28), and this was accepted by Gemminger and Harold. After comparing the two types, I do not agree with Chaudoir's view. *D. cœlestina* is rather a bright blue, instead of blue-green, the knees and apex of antennal joint 1 faintly fuscous; it is larger, longer, and a little more densely punctate throughout; the prothorax wider, the elytra longer and rather flatter, the punctures in the striæ smaller and more numerous, the outer angle of apical truncature sharp, but hardly dentate, the claws only microscopically denticulate. It may prove to be a pale variety of *geniculata*, with a blue upper surface, but I have seen no similar example, and for the present treat the species as distinct.

8. *Omphra* (*Helluo*) *pilosa* (ibid. p. 71).

9. *Omphra* (*Helluo*) *atrata* (ibid. p. 72).

10. *Omphra* (*Helluo*) *rufipes* (ibid. p. 72).

11. *Pseudozæna* (*Ozæna*) *orientalis* (ibid. p. 81). Type at Berlin, but it was not available at the time of my visit and I did not see it.

12. *Miscelus javanus* (ibid. p. 82).

13. *Scarites bisquadripunctatus* (Peters, Reise Mossamb. Zool. v. 1862, p. 158).

Chaudoir considered this species as identical with *S. planus*, Bon. (Obs. Ent. ii. 1813, p. 470). The type is rather small (14 mm.), the prothorax somewhat narrow, with very evident front and hind angles, the tooth on shoulder of elytra extremely sharp, and the intervals more convex than usual. In spite of these differences I think Chaudoir's identification is correct.

W. F. Erichson.

I saw at the Zoological Museum the types of three out of the four under-mentioned species:—

1. *Colpodes* (*Anchomenus*) *lætus* * (Nov. Act. Leop. Carol. 1834, Suppl. xxii. t. xxxvii. fig. 2) = *Colpodes apicalis*, Chaud. (Ann. Soc. Ent. Fr. 1878, p. 278).

Erichson's name being much older than Chaudoir's, the species should be known as *Colpodes lætus*. Chaudoir, in his 'Monographie du Genre *Colpodes*' (Ann. Soc. Ent. Fr. 1859, p. 326), has written the following note under his *C. amœnus*:—"Elle a un faux air de ressemblance avec l'*Anchomenus lætus*, Erichson, qui, comme on le sait, se retrouve à Java et à Hongkong." He seems to have misidentified some other species as *lætus*, but I am not aware what it was. Erichson's species, so far as I know, is confined to the island of Luzon: I have seen only six examples, viz. four in the Berlin Zool. Mus., Chaudoir's type of *apicalis*, and a specimen in the British Museum. The figure is fairly good, but the elytra should be bluer, and their margins, except close to apex, only very narrowly red.

2. *Scarites chinensis* (ibid. p. 220) = *S. sulcatus*, Oliv. (Ent. iii. 36, 1795, p. 7, t. i. fig. 11).

3. *Scarites troglodytes* (Wiegm. Arch. 1843, p. 214) = *S. picicornis*, Dej. (Spec. Gen. v. 1831, p. 493).

4. *Egaploa* (*Stenolophus*) *fulvipes* (ibid. p. 216) = *E. crenulata*, Dej. (Spec. Gen. iv. 1829, p. 432). I did not see this type, but it is no doubt in the Berlin Museum.

J. Nietner.

The species described by Nietner all came from Ceylon, where he was resident for many years and made extensive collections. Many specimens found their way into European collections, notably those of Schaum, Dohrn, and the Berlin Museum. The collection of Dohrn, which I examined two or three years ago, is now in the Stettin Museum, and a number of the labels on the specimens are marked with a star as having been verified by the author. Many labels on specimens in the Berlin Museum are similarly marked as having been verified by Gerstäcker, and I have seen nothing to lead me to suppose that these verifications are other than trustworthy. When, therefore, in connexion with this author, I use the word "type," it means a specimen from Nietner's collection, verified as correctly named.

The species were all described in the 'Annals and Magazine of Natural History,' (2) xix. 1857 and (3) ii. 1858 (referred to below as 'Annals'), although some of them were also described a little earlier in the 'Journal of the Asiatic Society of Bengal' (referred to as 'Journal'). For convenience, both genera and species are taken alphabetically.

1. *Abacetus* (*Distrigus*) *æneus* (Annals, (3) ii. 1858, p. 177) = *A. placidulus*, Walk. (Annals, (3) ii. 1858, p. 203). Type at Berlin.

Nietner's name was preoccupied.

2. *Abacetus* (*Drimostoma*) *ceylanicus* * (Annals, (3) ii. 1858, p. 178) = *A. lioderes*, Bates (Annals, (5) xvii. 1886, p. 144). Type at Berlin, where there are six specimens in all, presented by Nietner.

The description of this species under the genus *Drimostoma* has effectively prevented its recognition by Chaudoir, Bates, or Tchitcherin, none of whom could have seen an example of it. As far as it goes, the description agrees fairly with the specimens.

3. *Abacetus* (*Distrigus*) *costatus* (Annals, (3) ii. 1858, p. 176)=*A. atratus*, Dej. (Spec. Gen. iii. 1828, p. 194). Type at Berlin.

4. *Abacetus* (*Distrigus*) *dejeani* (Annals, (3) ii. 1858, p. 178). Type at Berlin.

5. *Abacetus* (*Distrigus*) *rufopiceus* * (Annals, (3) ii. 1858, p. 177)=*A. henryi*, Andr. (Spol. Zeyl. 1923, p. 238). Type at Berlin.

Chaudoir did not know this species.

6. *Abacetus* (*Distrigus*) *submetallicus* * (Annals, (3) ii. 1858, p. 177)=*A. chalceolus*, Chaud. (Bull. Mosc. 1869, ii. p. 384). Type at Berlin.

Erroneously identified by Chaudoir in his Monograph of the genus (p. 391) with *A. antiquus*, Dej.: this identification was presumably made from the description.

7. *Amblystomus* (*Megaristerus*) *indicus* (Annals, (3) ii. 1858, p. 428). Type at Berlin.

8. *Amblystomus* (*Megaristerus*) *mandibularis* (Annals, (3) ii. 1858, p. 428). Type at Berlin.

9. *Amblystomus* (*Megaristerus*) *stenolophoides* (Annals, (3) ii. 1858, p. 428). Type missing.

There are specimens bearing the name in the Stettin Museum, but there seems no reason to suppose that they are typical.

10. *Anchista modesta* (Journal, 1856, vi. p. 523)=*A. brunnea*, Wied. (Zool. Mag. ii. 1, 1823, p. 59=*A. picea*, Chaud. Bull. Mosc. 1877, ii. p. 238). Type at Stettin.

11. *Anoplogenius* (*Lepithrix*) *foliolosus* (Journal, 1857, ii. p. 152)=*A. discophorus*, Chaud. (Bull. Mosc. 1852, i. p. 90). Typical specimens both at Berlin and Stettin.

12. *Barysomus* (*Oosoma*) *arenarius* (Journal, 1857, ii. p. 146) =*B. gyllenhali*, Dej. (Spec. Gen. iv. 1829, p. 59). Typical specimens at Berlin and Stettin.

13. *Barysomus* (*Oosoma*) *gerstaeckeri* (Journal, 1857, ii. p. 147)=*B. semivittatus*, F. (Suppl. Ent. Syst. 1798, p. 59). Typical specimens at Berlin and Stettin.

14. *Bembidion opulentum* (Annals, (3) ii. 1858, p. 420). Redescribed by Bates under the name of *B. europs* (Annals, (5) xvii. 1886, p. 156). Type at Berlin.

15. *Bradybænus* (*Calodromus*) *exornatus* (Annals, (3) ii. 1858, p. 181 = *B. festivus*, Dej. (Spec. Gen. iv. 1829, p. 163) = *B. ornatus*, Redt. (Reis. Novar. ii., Col. 1867, p. 14). Type at Berlin.

16. *Chlænius cupricollis* (Journal, 1856, v. p. 387) = *C. circumdatus*, Brullé (Silb. Rev. Ent. iii. 1835, p. 283). Type at Stettin, but Chaudoir says in his Monograph of the genus that he also has an authentic example, which is now at Rennes.

17. *Chlænius dohrni* (Journal, 1857, ii. p. 149) = *C. parallelus*, Dej. (Spec. Gen. v. 1831, p. 627). Type at Berlin.

18. *Chlænius maleolens* (Journal, 1857, ii. p. 148) = *C. posticus*, F. (Suppl. Ent. Syst. 1798, p. 57). This species has an extensive synonymy. Type at Berlin.

This specimen is more evidently pubescent than usual, and also has the prothorax more densely punctate.

19. *Chlænius princeps* (Journal, 1857, ii. p. 147) = *C. quadricolor*, Oliv. (Enc. Méth. v. 1790, p. 344). Chaudoir supposed the species to be synonymous with his *C. bengalensis* (Bull. Mosc. 1856, iii. p. 262). Typical specimens at Berlin and Stettin.

20. *Chlænius pulcher* (Journal, 1856, v. p. 387). Type at Stettin.

First described by Dejean under the name of *C. marginatus* (Spec. Gen. ii. 1826, p. 305) and, as this name was preoccupied, renamed *C. marginifer* by Chaudoir in his Monograph. This was after the appearance of Nietner's description, so that *pulcher* stands.

21. *Chlænius quinquemaculatus* (Journal, 1856, v. p. 386) = *C. xanthospilus*, Wied. (Germ. Mag. iv. 1821, p. 115). Type at Berlin.

22. *Chlænius rugulosus* (Journal, 1856, v. p. 388). Type at Stettin.

23. *Clivina elongatula* (Journal, 1856, v. p. 390).

I saw no example at Berlin, though there is one at Stettin, but Putzeys, in his '*Révision Générale des Clivinides*' (p. 123), informs us that a specimen in Chaudoir's collection (now at Rennes) is the type on which Nietner drew up his description. I overlooked this in my recent paper on the genus *Clivina* (Annals, (9) xvii. 1926, p. 371), in which also there is an unfortunate misprint on p. 376, where "*elongatula*" appears as "*elegantula*."

24. *Clivina rugosifrons* (Journal, 1856, v. p. 390) = *C. memnonia*, Dej. (Spec. Gen. v. 1831, p. 503.

There is an example at Berlin from Nietner's collection, and Putzeys says (Postscr. p. 35) that Nietner sent him several specimens from Ceylon. All these are apparently authentic.

25. *Colpodes* (*Euplynes*) *dohrni* (Annals, (3) ii. 1858, p. 429) = *C. ruficeps*, Macl. (Ann. Jav. 1825, p. 25). Type at Berlin.

This confirms the view I recently expressed (Spol. Zeyl. 1924, p. 137).

26. *Coryza* (*Clivina*) *maculata* (Journal, 1856, v. p. 391). Type at Stettin.

27. *Creagris labrosa* (Journal, 1857, ii. p. 139). Typical examples at Berlin and Stettin.

28. *Cyclosomus dytiscoides* (Journal, 1857, ii. p. 132) = *C. flexuosus*, F. (Syst. Ent. 1775, p. 246). Type at Berlin.

29. *Dioryche* (*Selenophorus*) *colombensis* (Journal, 1857, ii. p. 151).

In this case there are examples at Berlin, which came from Nietner's collection, and which agree with the traditional identification, but no name is attached, and a type must be regarded as missing.

30. *Diplocheila* (*Symphyus*) *unicolor* (Annals, (3) ii. 1858, p. 180 = *D. polita*, F.* (Ent. Syst. i. 1792, p. 146). Type at Berlin.

31. *Harpalus advolans* (Journal, 1856, vi. p. 526). Type at Stettin, but I saw at Berlin an unnamed example of the species.

32. *Hololeius (Chlænius) ceylanicus* (Journal, 1856, v. p. 385) =*H. nitidulus*, Dej. (Spec. Gen. ii. 1826, p. 341). Typical examples at Berlin and Stettin.

33. *Odacantha (Casnonia) pilifera* (Annals, (3) ii. 1858, p. 179). Type missing, but the description is unusually long and detailed, and the traditional identification seems correct.

34. *Odacantha (Casnonia) punctata* (Annals, (3) ii. 1858, p. 178). Type at Berlin.

O. fuscipennis, Chaud., *O. punctata*, Nietn., *O. hæmorrhoidalis*, Motch., and *O. flavicauda*, Bates, appear to differ very little from each other; they may all prove to belong to the same species, but at present I have not the means of deciding this.

35. *Oodes piceus* (Journal, 1856, vi. p. 526). Type at Stettin.

Redescribed by Chaudoir (Bull. Mosc. 1857, iii. p. 32) under the name of *O. vilis*.

36. *Pentagonica (Elliotia) pallipes* (Journal, 1856, vi. p. 525). Type at Stettin.

37. *Perileptus (Ochthephilus) ceylanicus* (Journal, 1857, ii. p. 136). Type at Stettin.

38. *Planetes (Heteroglossa) bimaculatus* (Journal, 1857, ii. p. 144)=*P. ruficeps*, Schaum (Berl. Ent. Zeitschr. 1863, p. 81). Typical examples at Berlin and Stettin.

Nietner's specific name being preoccupied, Schaum's was proposed to replace it.

39. *Planetes (Heteroglossa) elegans* (Journal, 1857, ii. p. 143). Typical examples at Berlin and Stettin.

40. *Planetes (Heteroglossa) ruficollis* (Journal, 1857, ii. p. 144). Typical examples at Berlin and Stettin.

41. *Platymetopus (Ophonus) rugosus* (Journal, 1857, ii. p. 150). Type at Stettin, but there are examples at Berlin.

42. *Platymetopus* (*Ophonus*) *senilis* (Journal, 1857, ii. p. 150) = *P. flavilabris*, F. (Suppl. Ent. Syst. 1798, p. 59). Type at Stettin, but there are unnamed examples at Berlin.

43. *Scarites minor* (Journal, 1856, v. p. 389). A variety of *S. picicornis*, Dej. (Spec. Gen. v. 1831, p. 493). No examples at Berlin or Stettin, but Chaudoir says in his 'Monographie des Scaritides (ii.)' (p. 57) that a type of Nietner is in his collection.

44. *Zuphium pubescens* (Annals, (3) ii. 1858, p. 182). Type at Berlin.

A slight variety of *Z. olens*, Rossi (Faun. Etrusc. i. 1790, p. 217), redescribed by Chaudoir (Bull. Mosc. 1862, iv. p. 311) under the name of *Z. rufifrons*.

W. W. SAUNDERS.

In Ann. & Mag. Nat. Hist. (9) xvii. 1926, p. 259, I noted that the types of four of the species described by Saunders under the genus *Catascopus* (Trans. Ent. Soc. Lond. 1863, pp. 455–69) were not to be found in Mr. René Oberthür's collection at Rennes. Three of these types are at Berlin, viz., those of *Catascopus æneus*, *C. lævipennis*, and *Holcoderus* (*Catascopus*) *elongatus*. The type of the remaining species, *C. rugicollis*, was not to be found there.

H. R. SCHAUM.

Types of all the under-mentioned Oriental species are in the Berlin Zool. Mus., but of *Peronomerus fumatus* and *Pericalus lætus* there are also examples in the Deutsch. Ent. Mus., with equal claims to rank as type.

1. *Craspedophorus* (*Isotarsus*) *mandarinus* (Ann. Soc. Ent. Fr. 1853, p. 436).

2. *Dischissus* (*Isotarsus*) *guttiferus* (ibid. p. 437).

3. *Trichisia* (*Isotarsus*) *cyanea* (ibid. p. 439). Redescribed by Mr. E. Csiki as *T. chinensis* (Ann. Mus. Hung. 1907, p. 576).

4. *Peronomerus fumatus* (ibid. p. 440).

5. *Serrimargo* (*Thyreopterus*) *guttiger* (Berl. Ent. Zeitschr. 1860, p. 189).

6. *Pericalus lætus* (ibid. p. 190). Redescribed by L. W. Schaufuss as *P. adonis* (see below).

7. *Pericalus xanthopus* (ibid. p. 191).

8. *Bembidion luridipenne* (ibid. p. 199).

9. *Pericalus gratus* (Berl. Ent. Zeitschr. 1861, p. 124).

10. *Mouhotia* (*Scaritarchus*) *midas* (Proc. Ent. Soc. Lond. 1862, p. 94 (Sept.)) = *M. gloriosa*, Cast. (Rev. et Mag. Zool. 1862, p. 306 (Aug.)).

I do not know exact dates of publication, but priority has always been accorded to Castelnau's name—I should think correctly.

11. *Bothynoptera dorsigera* (Journ. Ent. ii. 1863, p. 76, t. iv. fig. 3).

12. *Hexagonia bowringi* (Berl. Ent. Zeitschr. 1863, pp. 73 & 433).

13. *Pentagonica suturalis* (ibid. p. 75).

14. *Planetes immaculatus* (ibid. p. 81).

15. *Mastax pœcilus* (ibid. p. 82).

16. *Dischissus* (*Craspedophorus*) *longicornis* (ibid. p. 84) = *D. notulatus*, F. (Syst. Eleuth. i. 1801, p. 201).

17. *Callistomimus* (*Callistus*) *modestus* (ibid. p. 85).

18. *Callistomimus* (*Callistus*) *westwoodi* (ibid. p. 85) = *C. littoralis*, Motch. (Etud. Ent. 1859, p. 33).

I have seen no typical specimen of Motchulsky's species, but there seems little doubt about the identification.

19. *Craspedonotus tibialis* (ibid. p. 87).

20. *Disphæricus marginicollis* (Berl. Ent. Zeitschr. 1864, p. 122).

This type was not available when I was in Berlin, and I was consequently unable to see it.

J. Putzeys.

In Ann. & Mag. Nat. Hist. (9) xvii. 1926, p. 376, I said that the types of *Clivina helferi* and *C. wallacei* should be found in the Berlin Zool. Mus., but both of them appear to be missing.

B. de Harold.

1. *Euplynes batesi* (Deutsch. Ent. Zeitchr. 1877, p. 341). Type at Berlin.

2. *Euschizomerus metallicus* (Stett. Ent. Zeit. 1879, p. 331). Type at Berlin.

M. de Chaudoir.

1. *Oodes cœlestinus* (Ann. Soc. Ent. Fr. 1882, p. 363). Type at Berlin.

L. W. Schaufuss.

The author says that the types of the Malayan Carabidæ described by him are in the "Museum Ludwig Salvator," but I found them to be in the Berlin Zoological Museum.

1. *Miscelus javanus*, Klug, var. *planatus* (Hor. Soc. Ent. Ross. xix. 1885, p. 183).

No specimen was labelled *planatus*, but one bearing the name *celebensis* appeared to be the type. The name is quite superfluous.

2. *Miscelus celebensis* (ibid. p. 184) = *M. javanus*, Klug, var. *unicolor*, Putz.* (Mém. Soc. Liège, ii. 1845, p. 375).

3. *Galerita carinifrons* (Hor. Soc. Ent. Soc. Ross. xxi. 1887, p. 103).

I have seen no other examples.

4. *Pericalus adonis* (ibid. p. 104) = *P. lætus*, Schaum * (see above).

5. *Chlænius bimaculatus*, Dej., var. *celebensis* (ibid. p. 105).

I did not see this specimen, but the name is evidently superfluous.

6. *Dioryche* (*Gnathaphanus*) *ærea* (ibid. p. 105) = *D. cavernosa*, Putz.* (Ann. Mus. Civ. Gen. 1875, p. 737).

7. *Platymetopus obscuripes* (ibid. p. 106).

A variety of *P. flavilabris*, F. (Suppl. Ent. Syst. 1798, p. 59), which seems hardly distinguishable from var. *thunbergi*, Quens. (in Schönh. Syn. i. 1, 1806, p. 188 (note)).

8. *Trigonotoma verberifera* (ibid. p. 106). Apparently confined to Celebes.

9. *Lesticus crenicollis* (ibid. p. 107). Apparently confined to Celebes.

H. Kuntzen.

All Dr. Kuntzen's types are in the Zoological Museum, namely, those of *Lesticus assamicus*, *gregori*, *insignis*, Gestro, var. *philippinicus*, and *sauteri*; also that of *Trigonotoma venus*, Tchitch., var. *preyeri*. All of them were described in Ent. Rundsch. 1911, pp. 165, 175, and 182.

P. Dupuis.

1. *Pheropsophus kuntzeni* (Ann. Soc. Ent. Belg. 1914, p. 29) = *P. javanus*, Dej.* (Spec. Gen. i. 1825, p. 305).

Though differing in appearance from typical *javanus*, this can hardly be more than a form of that very variable species.

T. G. Sloane.

At the Deutsch. Ent. Institut at Dahlem I also saw, through the kindness of Dr. W. Horn, the types of the species of Carabidæ described by Mr. T. G. Sloane in Deutsch. Ent. Zeitschr. 1907, pp. 177–85 and 467–74: the solitary type of *Sinurus obscurus* was not found at the time, but it is in all probability there. The species in question are as follows:—*Colpodes bennigseni* and *habilis*, *Macrocentra* (*Loxocara*) *quadrispinosa* (= *M. quadrispinosa*, Chaud.) and *violacea*, *Phlæocarabus basalis*, *Platia* (*Agonochila*) *lineella* (= *P. papuensis*, Sl.), *Sinurus? obscurus*, *Pogonoglossus horni*, *Chlænius occultus*, *Stenolophus robustus* (= *S. dingo*, Cast.), *Lesticus nitescens* and *bennigseni*, and *Desera* (*Dendrocellus*) *elegans*.

I take the opportunity afforded by this paper to make one or two further notes:—

(1) *Harpalus idiotus*, Bates (Proc. Zool. Soc. Lond. 1889, p. 213) = *H. quadricollis*, Redt.* (in Hügel's Kaschmir, iv. 2, 1844, p. 502).

(2) In a memoir published in 1924 (Mission Babault Ind. Carab. p. 37) I identified a number of specimens as *Harpalus amarellus*, Bates (Entom. xxiv. 1891, Suppl. 10). An assiduous search for the type of this species at Rennes having proved unavailing, I am treating it as lost. On the same occasion Mr. René Oberthür kindly gave me some specimens of a *Harpalus* taken by J. H. Leech in the Goorais Valley, which I cannot distinguish from the widely-spread palæarctic *H. anxius*, Dufts., or from the examples formerly identified as *amarellus*. I think this identification was wrong, and that the specimens in question are really *anxius*: *H. amarellus* is unknown to me.

(3) *Amara* (*Leiromorpha*) *brucei*, Andr. (Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 276). I think this species should be placed in the subgenus *Cumeres*. It is very clearly allied to *A. thalia*, Andr. (Ent. Month. Mag. 1926, p. 76), and makes a third species of that group.

VIII.—*Notes on the Controversy respecting the Priority and Generic Status of* Eupteryx, *Curtis, and* Typhlocyba, *Germar* (*Homoptera*, *Jassoidea*). By W. E. China.

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There has existed in the past considerable confusion between the genera *Eupteryx*, Curtis, and *Typhlocyba*, Germar, especially as understood by European homopterists on the one hand and American homopterists on the other.

In 1918, however, W. L. McAtee * clearly stated the facts of the case, and apparently settled the question permanently in favour of the views held by European entomologists for the last fifty years.

E. P. Van Duzee †, however, has recently queried the

* Proc. Biol. Soc. Washington, xxxi. pp. 112–113 (1918).
† 'Pan-Pacific Entomologist,' iii. no. 1 (July, 1926).

conclusion of McAtee that *Eupteryx*, Curtis, has priority over *Typhlocyba*, Germar. He remarks, "I shall continue to use the Germar names in preference to those of Curtis, as I have done in the past." But, even if it could be proved that *Typhlocyba* had priority, this would make no difference in this dispute, since, as McAtee has pointed out, the two genera remain distinct on the basis of validly selected types, and Van Duzee's assignation of *aurata* (L.) as type of *Typhlocyba* is invalidated by the previous citations of Woodworth, Oshanin, and Distant in favour of *quercus*, Fabricius. Neither of these two genera, therefore, can now be synonymised with the other.

Apart from this, however, the question of the priority of one or other of these two names remains of interest, because these two genera are the oldest in the family, and accordingly the family-name may depend on the correct solution of the problem. Mr. Van Duzee bases his conclusion that Germar's name is the older on two facts:—

(1) That Curtis himself in his remarks to Plate 633 of his 'British Entomology' (Feb. 1, 1837) stated: "My genus *Aphrodes* comprised two groups, one of which had been *previously* established under the name of *Acucephalus* by Germar."

(2) That on page 314 of the 'Entomological Magazine,' vol. i., April 1833, appears a reply by the editor to a letter from "Delta," in which he (the editor) states that a correspondent, signing himself "X. Y. Z.," has written claiming that every genus (including *Eupteryx*) except one described in Curtis's article had been previously characterised.

Fact no. 2 can scarcely be relied upon as an indication of the priority of *Typhlocyba*. In the first place, "X. Y. Z."'s assertion was inaccurate. Curtis's article contained descriptions of twenty-six genera in no less than five different orders. It is incredible that all these except one could have been previously characterised. In point of fact, they were not, for in the Hemiptera alone *Hebrus*, *Pantilius*, *Galeatus*, *Criomorphus*, and *Agallia* are still valid genera with no history previous to Curtis's paper. Van Duzee rather hastily assumes that "X. Y. Z." was referring to Germar's paper in part iv. of Silbermann's 'Revue,' but, as will be shown later, this periodical at that time (Jan. 1833) had not even commenced publication. It is just possible that "X. Y. Z." may have been acquainted with Germar's manuscript notes and names, for at that time manuscript names or "cabinet"

names were often regarded as valid, and were commonly interchanged between entomologists. It is much more probable, however, in view of the petty jealousies of the period, that "X. Y. Z." was simply trying to discredit the newly commenced 'Entomological Magazine,' or it may be that, as was customary at that time, he was merely complaining of the splitting up of the old genera and really meant that these new genera were covered by the previous characterisations of the older genera from which they had been separated by Curtis. The editor, to whom this letter was addressed, regarded it as *nonsense*. He wrote: "X. Y. Z. must supply us with references in proof of the assertion, otherwise his communication is, what he is pleased to term Mr. Curtis's, 'waste-paper.' With the elegant epistle which dared us to omit its publication we lighted our cigar."

Fact no. 1 is much harder to explain. Perhaps Curtis was referring to the existence of Germar's manuscript name, *Acucephalus*, previous to his own description of *Aphrodes*, or, perhaps, remembering that Germar's name had been published in the same year as his own, he erroneously surmised that Germar's name appeared first. It must be remembered that he wrote that statement four years after his original description of *Aphrodes*, and it is certain that he cannot have troubled to check the date of publication of the two names. However this may be, the fact remains that we are concerned only with the published names, and as there is no record of the publication of *Typhlocyba* previous to its appearance in part iv. of Silbermann's 'Revue Entomologique,' we must accept the date of publication of that work as that of *Typhlocyba*. There is indisputable evidence that Silbermann's 'Revue Entomologique' was not published until after January 1833. The British Museum (Nat. Hist.) copy of Silbermann's 'Revue' was purchased from Prof. Lacordaire's library, and volume i. contains a letter from Gustav Silbermann to Lacordaire in which he writes:

"J'ai l'honneur de vous envoyer ci-joint le premier cahier de ma Revue entomologique entreprise que j'ai créé par zèle pour la belle science qui nous occupe."

This letter is signed and dated Strasbourg, 12 Mars, 1833, and was evidently sent to Lacordaire soon after the publication of the first part of the 'Revue' in the beginning of March.

In the "Bulletin Entomologique" of the 'Annals de la Société Entomologique de France,' vol. ii. p. xxxviii (1833), under the heading "Séance du 5 juin," is a reference to the

gift to the Society of a reprint of the 'Catalogue des Lepidoptères du département du Var," by the author, M. Cantener. This catalogue was published in the second part of Silbermann's 'Revue' and had a preface by the author dated 24 Mars, 1833. The second part of the 'Revue' thus appeared between the 24th March and the 5th June, and was doubtless published in May.

In the "Bulletin Entomologique" for September 4th, in the 'Annals de la Société Entomologique de France,' vol. ii. p. lxi (1833), under the title "Ouvrages d'Entomologies publiés depuis le 1er juillet, 1833," is a reference to the "'Revue Entomologique' par Gustave Silbermann, livraisons 3, 4, and 5." This shows that these three parts were published between July 1st and September 4th, and, in fact, appeared in July, August, and September respectively.

It is clearly evident, therefore, that the first five parts of Silbermann's 'Revue' appeared in March, May, July, August, and September, at the beginning of each month, and since Germar's paper, including his description of *Typhlocyba*, appeared in part iv., the exact date of publication of *Typhlocyba* is the beginning of August 1833. If further proof is wanted, Germar actually signed and dated his article "Halle, 3 juillet, 1833." As McAtee has shown, there is also plenty of evidence to prove that Curtis's paper appeared in January 1833. In the introduction to the 'Entomological Magazine' (vol. i. p. 4), which is dated September 1832, it was stated that the second number of the work would appear on the 1st January, 1833, and would be subsequently published quarterly. Part 2, containing Curtis's paper, commenced with page 105, and was dated January 1833. It reached subscribers in time to enable one of them ("Delta") to write a letter of criticism by the 10th of that month. There is thus abundant evidence that *Eupteryx*, Curtis, was published seven months before *Typhlocyba*, Germar, and, as has already been pointed out, it is the date of publication only that really concerns us in the solution of this problem. Until, therefore, someone can point out a work published prior to January 1st, 1833, in which *Typhlocyba* was "*originally*" described, the priority of the Curtis names over those of Germar will remain undoubted.

My thanks are due to my colleague Mr. J. H. Durrant for his kind assistance in the preparation of these notes.

IX.—*An Analysis of the Genera of Neotropical Killifishes allied to* Rivulus *. By GEORGE S. MYERS.

THE neotropical killifishes allied to *Rivulus* form a natural group (*Pterolebias*, perhaps, excepted) distinguished from the others of the Pœciliid subfamily Fundulinæ by the attached orbital rim. To this group I have recently given the tribe name Rivulini ('Fish Culturist,' Philad. iv. no. 8, 1925, p. 371). Although the single character given is of little importance in other families, it may serve to distinguish the tribe until further studies of the Fundulinæ have been made.

The present group was last reviewed by Regan in 1912 (Ann. & Mag. Nat. Hist. (8) x. pp. 494–508 & 641–642). He recognizes three genera (*Rivulus*, *Pterolebias*, and *Cynolebias*), and adds another (*Cynopœcilus*) in the addendum. Much has been learned of the group since 1912, and the receipt at Indiana University of the magnificent Amazonian collections recently made by Dr. Carl Ternetz has added several new species.

I am much indebted to Mr. Arthur Rachow, of Hamburg, who, besides sending many other interesting fishes, has kindly presented me with the last specimen in his possession of the original type-series of *Cynopœcilus melanotænia* (Regan). Mr. Carl L. Hubbs, of the University of Michigan, Ann Arbor, has been kind enough to lend material of *Rivulus brevis*, for which species I have erected a new genus, and, besides, he has turned over to me for description a new *Rivulus* from Panama. Mr. J. T. Nichols, of the American Museum, New York, has allowed free use of many species of Pœciliidæ, including material of *Rivulus cylindraceus*, and Mr. C. M. Breder has sent paratypes of *R. chucunaque* and *R. c. sucubti*. Dr. C. M. L. Popta has kindly supplied a photograph of a *Rivulus* in the Leiden Museum.

With all the help received, however, the material available has not warranted a revision at the present time of the many species of *Rivulus*. Dr. Ernst Ahl, of the Zoologisches Museum, Berlin, has recently reviewed the species of *Cynolebias*.

Analysis of the Genera.

a. Caudal peduncle greatly compressed, its lower edge blade-like; fins, especially caudal and pelvics, pointed and often greatly attenuated;

* 'Contributions from the Zoological Laboratory of Indiana University,' No. 215.

dorsal moderate (rays 9–10), inserted considerably behind vertical of anal origin; anal long (rays 19–20). (Lower Amazon.) .... *Pterolebias*, [Garman *.

aa. Caudal peduncle not blade-like below.

b. Cleft of mouth forming a right-angled groove or pocket in front of eye; preorbital line nearly vertical or even inclined slightly backward.

c. Dorsal fin inserted over origin of anal fin.

d. Dorsal and anal of moderate length (D. 10, A. 12); pelvic fins separated by an interspace; body elongate, moderately compressed; caudal rounded. (Only female known.) (Paraguay.) .... *Neofundulus*, [Myers.

dd. Dorsal and anal long (D. 16–18, A. 17–20), rays similar in the sexes; pelvic fins separated by an interspace; body considerably compressed, but not very deep (depth $3\frac{1}{2}$–$4\frac{1}{2}$); caudal rounded or slightly pointed; dorsal and anal pointed. (Paranagua, S.E. Brazil.) .... *Cynopœcilus*, [Regan

ddd. Dorsal and anal long (D. 17–26, A. 17–33), rays more numerous in males; pelvic fins not separated by an interspace, sometimes confluent; body much compressed and rather deep (less than $3\frac{2}{3}$ in body-length); caudal rounded; dorsal and anal pointed in males. (S.E. Brazil to La Plata.).... *Cynolebias*, [Steindachner.

cc. Dorsal inserted considerably behind vertical of anal fin origin.

e. Head as deep as or deeper than wide; body rather compressed; pelvic fins with the anterior rays produced; dorsal and anal pointed (in males at least).

f. Preorbital line extending up behind and around the flapped nares; mandible not horizontal when mouth is closed; pectorals normal; caudal rounded-acuminate. (Matto-Grosso.) .... *Rivulichthys*, [gen. nov.

ff. Preorbital line not extending up behind and around the flapped nares; mandible horizontal when mouth is closed (as in *Rivulus*); males with attenuated pectorals and produced outer caudal rays. (Colombia.) .... *Rachovia*, [gen. nov.

ee. Head considerably wider than its greatest depth; body but little compressed, elongate; all fins rounded, no produced pelvic rays. (San Domingo, Cuba, and Mexico to the La Plata.) .... *Rivulus*, Poey.

bb. Cleft of mouth nearly straight, forming a very obtusely-angled groove before eye; line of preorbital very oblique; dorsal moderate

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* Should be placed under section *e* of the Synopsis, after *Rachovia*, with which it agrees in most characters, differing in the compressed caudal peduncle and the attenuated central caudal rays.

(rays 9–10), inserted considerably behind vertical of anal fin origin; anal long (rays 15–17); caudal rounded or slightly pointed; pelvics pointed or attenuate; body moderately compressed. (Tocantins.) .... *Trigonectes*, [gen. nov.

PTEROLEBIAS, Garman.

Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 141 (type *longipinnis*).

Of this genus only the type-species is known—*Pterolebias longipinnis*, Garman, from Santarem on the Lower Amazon. No other ichthyologist has seen specimens, and I have been unsuccessful in obtaining a cotype from Cambridge for examination. Dr. Ternetz made his most extensive collections at Santarem, and, although he collected many small Pœciliids there, no specimens of *Pterolebias* are in his material. Possibly the fish is of very specialized habits and habitat *.

Of the mouth, Garman says "it has an oblique cleft, as in *Orestias*." This would indicate that the mouth-cleft is right-angled, as in *Rivulus*, although the mouth in *Orestias* is not of exactly the same structure as that of *Rivulus*. If *Pterolebias* is like *Rivulus* in this, division "*b*" of my synopsis should be elevated to the major position, and "*a*" and "*aa*" be placed under it. The structure of the mouth is probably of greater importance than the compression of the caudal peduncle †.

The lateral line is said to be distinct. This is unusual for a Pœciliid, although an approach to this condition is seen in many of the Fundulinæ.

NEOFUNDULUS, Myers.

Myers, Amer. Mus. Novitates, no. 116, 1924, p. 9 (type *paraguayensis*).

This genus is close to *Cynopœcilus* and *Cynolebias*. A single species.

* I can scarcely believe that a viviparous Cyprinodont of the genus *Alfaro* exists in the Amazons. *A. amazonum* (Regan) was based on aquarium specimens and is probably the same as the Costa Rican *A. cultratum* (Regan).

† Since the above was in type, I have, through the courtesy of Dr. Samuel Henshaw, received two of the types of *Pterolebias longipinnis* for examination. The mouth is as in *Rivulus* and *Rachovia* and the head is as deep as wide. The anal region and the short peduncle are greatly compressed, but the latter can scarcely be described as "blade-like below." However, it may distinguish the genus from *Rachovia*, in which the compression is not nearly so great.

Neofundulus paraguayensis (Eigenmann & Kennedy).

Fundulus paraguayensis, Eigenmann & Kennedy, Proc. Acad. Nat. Sci. Philad. lv. 1903, p. 530; Eigenmann, Proc. U.S. Nat. Mus. xxxii. 1907, p. 432, fig.

This species is still known only from a single female specimen, Laguna near Arroyo Trementina, Paraguay.

CYNOPŒCILUS, Regan.

Regan, Ann. & Mag. Nat. Hist. (8) x. 1912. p. 642 (type *melanotænia*).

A single species of this genus is known—*Cynopœcilus melanotænia* (Regan), 1912, p. 506—from Paranagua, South-eastern Brazil. I have examined a cotype received from Mr. Arthur Rachow, of Hamburg, from whom Regan obtained his material.

CYNOLEBIAS, Steindachner.

Steindachner, Sitzb. Akad. Wien, lxxiv. 1876, p. 172 (type *porosus*).

This genus is remarkable for the sexual difference in the number of dorsal and anal rays. I have examined only the *C. belottii*, Steindachner, and there are possibly generic differences between some of the species. Dr. Ernst Ahl has reviewed the genus in two recent papers, "Die Gattung *Cynolebias*, Steindachner" (Blätter für Aquarien- und Terrarienkunde, xxxiii. 1922, no. 14, pp. 1–5 (of separate), and "Ueber einige neue Fische aus Südamerika" (Zool. Anz. lviii. 1924, pp. 358–359).

RIVULICHTHYS, gen. nov.

I know this genus only from Ribeiro's description and figures of *Rivulus rondoni*, the characters in the synopsis being derived principally from the figures. Specimens must be examined before this genus can be properly placed.

Genotype.—*Rivulus rondoni*, Ribeiro.

Rivulichthys rondoni (Ribeiro).

Rivulus rondoni, Ribeiro, Comm. Linh. Telegr. Estrat. Matto-Grosso Amazonas, publ. 58 (1920), 1923*, p. 7, pls. i., ii.

D. 9; A. 15; l. l. 36; l. tr. 12. Outer row of mandibulary and premaxillary teeth enlarged. Coloration consisting of dark longitudinal lines. This species, of which

* The date, in Dr. Ribeiro's autograph, on the copy received here is July 16, 1923.

Ribeiro had three specimens from Caceres, is the largest of the Rivulini, reaching 150 mm.

RACHOVIA, gen. nov.

This genus is close to *Rivulus*, but differs markedly in the compressed deep head and the attenuated fins of the males. A single species from Colombia. I take pleasure in dedicating this genus to Mr. Arthur Rachow, the well-known aquarist of Hamburg, who has sent me numerous interesting fishes.

Genotype.—*Rivulus brevis*, Regan.

Rachovia brevis (Regan).

Rivulus micropus (non Steind.), Kohler, Blätt. Aquar. Terr'kunde, xvii. 1906, p. 106, fig.
Rivulus brevis, Regan, 1912, p. 504; Henn, Ann. Carnegie Mus. x. 1916, p. 112.

I have examined the material recorded by Henn.

RIVULUS, Poey.

Poey, Memorias, ii. 1861, p. 307 (type *cylindraceus*).

This large genus is very constant in its characters. All the fins are always rounded, with the exception of a notch at the end of the upper or lower caudal rays in the males of a few species. The head is invariably wider than deep. I have listed the known species of *Rivulus*. They are very numerous, yet I doubt that more than half the species in the Amazon basin have been discovered.

Rivulus atratus, Garman.

Regan, 1912, p. 502.

Range.—Jutahy.

Rivulus brasiliensis (Valenciennes).

Regan, 1912, p. 504.

Range.—Brazil.

Rivulus breviceps, Eigenmann.

Regan, 1912, p. 504.

Range.—Shrimp Creek, Upper Potaro River, British Guiana.

Rivulus brunneus, Meek & Hildebrand.

Meek & Hildebrand, Field Mus. Publ. Zool. Ser. x. 1913, p. 86; 1916, p. 331.

Range.—Toro Point, Atlantic slope of Panama.

Rivulus chucunaque chucunaque, Breder.

Breder, Amer. Mus. Novitates, no. 180, 1925, pp 7, 8, fig.

Range.—Lower Rio Chucunaque, Pacific slope of Panama.

Rivulus chucunaque sucubti, Breder.

Breder, Amer. Mus. Novitates, no 180, 1925, p 8, fig.

Range.—Upper Rio Chucunaque basin, Pacific slope of Panama.

Rivulus compactus, sp. n.

Diagnosis.—This dwarf species is one of the most distinct in the genus, the bold dark mottling at once distinguishing it from all others. Scales lateral 27 to 29.

Description.—Body very compact, compressed posteriorly. Head flat, wider than deep, not bulging at the sides. Snout short and blunt. Eyes lateral, horizontally oval. Head $3\frac{1}{4}$ in length without caudal. Depth 4. Orbital diameter greater than snout, $3\frac{1}{2}$ in head. Interorbital $\frac{1}{3}$ head length. Caudal peduncle slightly deeper than long, its least depth $1\frac{3}{4}$ in head. Dorsal 7 (circa*), originating twice as far from pectoral insertion (or thrice as far from centre of eye) as from caudal base, over the posterior part of the anal base. Anal 10 (circa), ending under middle of dorsal base. Pectoral fins $\frac{5}{6}$ head length, just reaching origin of pelvic fins. Pelvics originating midway between tip of snout and caudal base, not reaching anal origin. Scales 27 to 29 in a lateral series from opercle to tail-root, several more on the latter; transverse $9\frac{1}{2}$; predorsal about 22. Scale similar to that of *R. dibaphus* in shape, nucleus centred, concentric striæ more numerous, angled apicad, the angles not growing more pointed towards edge. Basal radii 20 to 22, central 6 complete. Up to 25 mm. (32·5 mm. with caudal).

Coloration consisting of bold dark brown mottling of small spots on a pale yellow ground-colour. Venter plain. Dorsal, caudal, and anal faintly speckled.

* The fins are hardened in a lowered position, and it is impossible to be sure of the count.

Porto Nacional, Rio Tocantins, Goyaz, Brazil (Donna Franciquinha, shallow lake) (*Dr. Carl Ternetz*, Feb. 16, 1924).

Rivulus compressus, Henn.

Henn, Ann. Carnegie Mus. x. 1916, p. 111, pl. xviii. fig. 1.

Range.—Manáos.

Rivulus cylindraceus, Poey.

Regan, 1912, p. 500; Henn, Ann. Carnegie Mus. x. 1916, p. 108.
Rivulus marmoratus, Myers, Fish Culturist, iv. 1925, p. 370.

Range.—Cuba.

I have examined four fine specimens from Marianáo and Havana in the American Museum. My idea that *marmoratus*, Poey, was distinct was derived from Jordan & Evermann's rather garbled account, in which the "anal" of Poey's description is changed to "dorsal."

Rivulus dibaphus, sp. n.

Diagnosis.—A small, compact, dark-coloured species, with scales lateral 31 or 32; anal ending below posterior part of dorsal base; D. $8\frac{1}{2}$; A. $10\frac{1}{2}$; dark longitudinal lines between the scale-rows; posterior part of side in males with irregular blackish vertical bars; female without caudal spot. Probably nearest *R. strigatus*.

Description.—Body rather compact, subcylindrical anteriorly, somewhat compressed posteriorly. Head flat above, wider than deep; cheeks slighly bulging. Snout rather rounded. Eyes supero-lateral, horizontally oval. Head $3\frac{4}{5}$ in length without caudal. Depth $4\frac{3}{5}$. Orbital diameter considerably greater than snout, 3 in head-length. Interorbital a little less than half head. Caudal peduncle as deep as long, its least depth $1\frac{1}{2}$ in head. Dorsal originating twice as far from anterior border of eye as from caudal base (midway between caudal base and middle of pectoral fin), over middle of anal. Anal fin ending under posterior part of dorsal base. Pectoral fins $1\frac{2}{5}$ in head, not reaching origin of pelvics. Pelvics inserted midway between snout-tip and caudal base, not reaching anal origin. Scales lateral 31 to 32, a few more on caudal; $8\frac{1}{2}$ transverse; about 22 predorsal. Scales with nucleus centred, apico-lateral outline very obtusely rounded, basally truncate. Concentric striæ considerably fewer than in *Trigonectes*, meeting at angles along

a line from nucleus apicad, angles growing sharper towards border. No apical radii, basal radii about 18, none complete.

In coloration this species is one of the most attractive of the genus. Ground-tone dark purplish brown, venter white. Anteriorly, rows of dark spots run down the scale-series, possibly with a series of maroon dots between rows. Above the anal and posteriorly are several irregular vertical bars of dark purplish brown on a light ground-colour, this often ending in a more or less ocellated spot on the central part of the tail-root. (This has nothing to do with black caudal ocellus at the upper basal caudal rays of many female Rivuli.) The fins are dark, blackish, with faint specklings. The female has plain fins and the irregular bars of the peduncle are absent. She has instead series of faint, opposed, oblique lines, as in *R. strigatus*, and there is no caudal ocellus. Up to 27 mm. (33 mm. with caudal).

Igarapé do Ajamuri, Lower Amazon (*Dr. Carl Ternetz*, 1924).

Rivulus dorni, Myers.

Myers, Ann. & Mag. Nat. Hist. (9) xiii. 1924, p. 588.

Range.—Vicinity of Rio de Janeiro.

Rivulus elegans elegans (Steindachner).

Rivulus elegans, Regan, 1912, p. 498; ? Meek & Hildebrand, Field Mus. Publ. Zool. Ser. x. 1916, p. 331.

Range.—Colombia.

This species possibly intergrades with *R. urophthalmus*. Meek and Hildebrand's material possibly is not typical *R. elegans elegans*.

Rivulus elegans godmani (Regan).

Rivulus godmani, Regan, 1912, p. 499.
Rivulus elegans (part.), Henn, Ann. Carnegie Mus. x. 1916, p. 108.

Range.—Guatemala.

Rivulus frenatus, Eigenmann.

Eigenmann, Mem. Carnegie Mus. v. 1912, p. 453, pl. lxiv. fig. 2; Myers, Amer. Mus. Novitates, no. 129, 1924, p. 2.

Range.—Gluck Island, Essequibo River, British Guiana.

Rivulus geayi, Vaillant.

Regan, 1912, p. 502.

Range.—Carsevenne, French Guiana.

Rivulus hartii (Boulenger).

Regan, 1912, p. 501; Myers, Copeia, no. 135, 1924, p. 96.
? *Rivulus marmoratus* (non Poey), Metzelaar, "Over Tropisch Atlantische Visschen," Rapp. Kol. Curaçao, Tweede Ged. 1919, p. 24.

Range.—Venezuela to Colombia, and offshore islands along the coast.

If Metzelaar's count of the anal rays in his specimens was right, they can hardly be this species. Dr. C. M. L. Popta, of the Leiden Museum, has been kind enough to supply me with a photograph of one of Metzelaar's specimens. It seems to be a *R. hartii*. This is the only record of a *Rivulus* from salt water.

Rivulus heyei, Nichols.

Nichols, Bull. Amer. Mus. Nat. Hist. xxxiii. 1914, p. 143; Myers, Fish Culturist, iv. 1925, p. 370.

Range.—Saona Island, Santo Domingo.

Rivulus is probably present in Santo Domingo, but it seems a little surprising that we have as yet no record from the main island.

Rivulus hildebrandi, sp. n.

Diagnosis.—A large, blunt-headed, elongate species, allied to *R. ocellatus* and *R. waimacui* in the high scale count, 49 to 50, but differing from both in the absence of markings and in the greater distance from the pelvic tips to the anal fin. D. 9; A. 13 or 14. Female with a caudal ocellus. Probably near *R. peruanus*.

Description.—Body elongate, subcylindrical anteriorly, much less compressed than *waimacui*. Eyes slightly superolateral, almost round. Head flat above, wider than deep; cheeks slightly bulging. Snout much blunter than in *waimacui*. Head $4\frac{1}{5}$ (young) to $4\frac{2}{3}$ (adult) in length to caudal base. Depth $4\frac{2}{3}$ to a little more than 5. Orbital diameter slightly greater than snout, 3 in head (adult). Interorbital 2 in head. Caudal peduncle as deep as long, its least depth $1\frac{1}{2}$ in head. Dorsal originating twice as far from head or from middle of pectoral as from caudal base. Anal fin ending under middle or posterior third of dorsal base. Pectoral fins $1\frac{2}{5}$ in head, falling short by $\frac{2}{3}$ to almost a whole of their own length of reaching the vertical of pelvic fin origin. Pelvics inserted midway between snout-tip and caudal base, their tips falling short of the anal fin origin by their own length or more, not reaching the vent in either

male or female. Scales lateral 49 to 50, 5 or 6 more on the caudal base, 16 between dorsal and pelvics, about 35 predorsal, the predorsal series fading out and becoming irregular some distance before the dorsal fin. The scales are smaller in the breast region.

Colour plain brownish, darker above. Scales dark-edged, this sometimes appearing to form very fine, faint, dark lines between the scale-rows by the junction of borders. Dorsal, caudal, and anal fins of male faintly light-spotted, the last with a fine black seam. Females with plain fins and a small ocellus on the upper part of the caudal base, becoming somewhat obsolete with age. Up to 58 mm. (71 mm. with caudal).

Boquete, Chiriqui, Panama (*F. M. and H. T. Gaige*, March 7, 1923). Type no. 56876, Museum of Zoology, University of Michigan. Paratypes 22, no. 56877, M.Z.U.M.

This distinct species was very kindly turned over to me for description by Mr. Carl L. Hubbs, of the University of Michigan, with the suggestion that it be named after Mr. Samuel F. Hildebrand, who has added so much to our knowledge of the fishes of Panama. To this I heartily assented.

Rivulus holmiæ, Eigenmann.

Regan (part.), 1912, p. 497; Henn, Ann. Carnegie Mus. x. 1916, p. 110.

Range.—Holmia, Upper Potaro River, British Guiana.

Rivulus isthmensis, Garman.

Regan, 1912, p. 503: Meek, Field Mus. Publ. Zool. Ser. x. 1914, p. 110.
Rivulus flabellicauda, Regan, 1912, p. 500.

Range.—Costa Rica.

Meek has shown that the scale-count in Garman's original description was a misprint, and that *flabellicauda* is a synonym.

Rivulus magdalenæ, Eigenmann & Henn.

Eigenmann & Henn, in Henn, Ann. Carnegie Mus. x. 1916, p. 109; Eigenmann, Mem. Carnegie Mus. ix. 1922, p. 183, pl. xxvii. fig. 10.

Range.—Magdalena River, Colombia.

Rivulus mazaruni, Myers.

Myers, Amer. Mus. Novitates, no. 129, 1924, p. 1.

Range.—Mutusi Hole, Mazaruni River, British Guiana.

Rivulus micropus (Steindachner).

Regan, 1912, p. 500.

Range.—Rio Negro, Brazil.

Rivulus obscurus, Garman.

Regan, 1912, p. 502; Henn, Ann. Carnegie Mus. x. 1916, p. 111.

Range.—Lake Hyanuary and Manáos, Amazon.

Rivulus ocellatus, Hensel.

Regan, 1912, p. 497.

Range.—South-eastern Brazil, along the coast.

Rivulus ornatus, Garman.

Regan, 1912, p. 501.

Range.—Lower Amazon.

Rivulus peruanus (Regan).

Regan, 1912, p. 496.

Range.—Perim, Peru.

Rivulus punctatus, Boulenger.

Regan, 1912, p. 503; Henn, Ann. Carnegie Mus. x. 1916, p. 111.

Range.—Bolivia, the Paraguay River, and the La Plata.

Rivulus rogoaguæ, Pearson & Myers.

Pearson & Myers, in Pearson, Indiana Univ. Studies, no. 64, (1924) 1925, p. 51.

Range.—Lake Rogoagua, Bolivia.

Rivulus santensis (Köhler).

Rivulus elegans, var. *santensis*, Kohler, Blätt. Aquar. Terr'kunde, xvii. 1906, p. 408, fig.

? *Rivulus rachovii*, Ahl, Sitzb. Gesell. naturf. Freunde, (1923) 1925, p. 109; Rachow, Blätt. Aquar. Terr'kunde, xxxvii. 1926, p. 237, fig.

Range.—? Santos, South-eastern Brazil (and Pará).

Head 4¼, depth 5, dorsal 7, anal 12. Dorsal originating twice as far from middle of pectoral (or thrice as far from preopercle) as from caudal base, slightly behind the middle of the anal base. Anal ending below posterior part of dorsal

base. Pectorals far distant from pelvics ; pelvics not reaching vent. Body more compact than in *elegans*. Male with a dark seam on the caudal. Female "ist über und über mit leuchtend blauen Pünktchen bedeckt."

Köhler gave only a colour-description of some aquarium specimens, but he gave a good photograph, from which I have derived most of the description. It is very possible the locality he gives is not correct.

I can see no good reason for not assigning *R. rachovii* to the synonymy of this species—in fact, everything points to their being the same. Both are asserted to be the fish long ago imported into Germany as an aquarium fish under the name *Rivulus elegans*. Both are based on aquarium specimens. Rachow does not mention the blue spots of the female, however. I leave *rachovii* in the synonymy with a query. It was described from Pará.

Rivulus strigatus, Regan.

Regan, 1912, p. 502; ? Pearson, Indiana Univ. Studies, no. 64, (1924) 1925, p. 51.

Range.—Amazon (? and Bolivia).

There are two recognizable forms in Pearson's material, and I doubt very much that either is *strigatus*.

Rivulus tenuis (Meek).

Regan, 1912, p. 499.

Range.—Southern Mexico.

Rivulus urophthalmus, Günther.

Regan, 1912, p. 498 (minus *frenatus* in the synonymy).

Range.—Amazon and Guiana.

In the head-waters of the north-western tributaries of the Amazon this species may intergrade with *elegans*. Specimens are at hand from Iquitos and Yurimaguas, Peru, collected by Dr. Wm. R. Allen.

Rivulus waimacui, Eigenmann.

Rivulus holmiæ (part.), Regan, 1912, p. 497.
Rivulus waimacui, Henn, Ann. Carnegie Mus. x. 1916, p. 110.

Range.—Potaro River, below the Kaieteur Fall, British Guiana.

Rivulus xanthonotus, Ahl.

Ahl, Blätt. Aquar. Terr'kunde, xxxvii. 1926, p. 315, fig.

Range.—Amazon.

Probably a number of distinct races, distinguished principally by colour, have been confused under *R. urophthalmus*. This seems to be one of these, as probably is *R. mazaruni* also. Field-work alone can answer the question of their validity.

Rivulus zygonectes, sp. n.

Diagnosis.—Closely allied to none of the known species. Scales lateral 37 to 39; anal ending below posterior part of dorsal base; D. $8\frac{1}{2}$ to $9\frac{1}{2}$; A. $13\frac{1}{2}$; a diffuse dark band from snout, through eye to tail-root; posterior sides with two rows of opposed oblique lines; female with a small caudal ocellus.

Description.—Body elongate, subcylindrical anteriorly, much compressed posteriorly. Head flattened, wider than deep, little if at all bulging at the sides. Snout rather pointed. Eyes slightly supero-lateral, horizontally oval. Head 4 in length without caudal. Depth 5 to $5\frac{1}{3}$. Orbital diameter greater than snout, $2\frac{3}{4}$ to 3 in head-length. Interorbital half head-length. Caudal peduncle longer than deep, its least depth $1\frac{2}{3}$ in head. Dorsal originating twice as far from centre of opercle as from caudal base, over the middle of the anal. Anal ending under posterior part of dorsal base. Pectoral fins $\frac{5}{6}$ head-length, nearly reaching to vertical of origin of pelvics. Pelvics inserted midway between snout-tip and caudal base. Scales 37 to 39 in a lateral series from upper end of gill-cleft to caudal base, 4 more on the latter; transverse $8\frac{1}{2}$ to $9\frac{1}{2}$; predorsal about 27. The scales are irregular and not all of the same size, both on the sides and in the predorsal area. A few down the sides show small pits, indicative of a rudimentary lateral line. Scales in general similar to those of *R. dibaphus*, basally the angles more sharp; more concentric striæ, scarcely angled apicad; nucleus slightly apicad of centre; basal radii 19 or 20, several complete.

Coloration very similar to that of *Zygonectes notatus*. The markings are more contrasted and brilliant on the female, as in alcohol specimens of many Pœciliids. In life the male probably has the more delicate and beautiful colours. Brownish above, whitish beneath. A somewhat diffuse dark band from under jaw, through eye, to tail-root, darkest on

the opercle and fading a little posteriorly. Anteriorly it forms the border of the light venter. On the sides behind vertical of dorsal insertion are two rows of faint, opposed, oblique light and dark lines, meeting at the middle of the sides, the angles forward. This coloration is scarcely or not at all indicated on males, but is plain on most of the females. Vertical fins of males dully mottled; in the females these fins are brilliantly marked with dark specks, and there is a small irregular ocellus at the upper part of the tail-root. Underside of head finely mottled in females, plain in males. Up to 34 mm. (42 mm. with caudal).

Vereda (Extrema), into Cannabrava, Goyaz, Brazil, types, Feb. 14, 1924; also from Brejo alegre or Cangussú, Goyaz, Jan. 15, 1924 (*Dr. Carl Ternetz*).

TRIGONECTES, gen. nov.

Distinguished from all the other genera of the group by the almost straight mouth-cleft. This genus dates from its first appearance, with a short diagnosis and indication of type-species *. It is here fully described for the first time. It is named from the small wedge-shaped schools in which Pœciliid fishes of this type are so often seen swimming along the surface.

Genotype.—*Trigonectes strigabundus*, Myers.

Trigonectes strigabundus, sp. n.

Body moderately elongate, compressed, head as deep as wide. Snout rather pointed, lower jaw somewhat projecting; mouth narrow, appearing pointed from above. Head $3\frac{1}{3}$ to $3\frac{1}{2}$ in length to caudal base. Depth $4\frac{1}{2}$. Eye large, $2\frac{3}{4}$ in head. Interorbital $2\frac{2}{3}$ in head-length. Snout $\frac{2}{3}$ as long as eye. Caudal peduncle, measuring from end of anal base to first lower rays of caudal, somewhat deeper than long, the least depth 2 in head. Dorsal 9 to 10, originating twice as far from the eye or preopercle as from caudal base, over the first third in length of anal base. Anal 15 to 17. Pectorals $\frac{3}{4}$ head-length, reaching the pelvic origin. Pelvics with 7 rays, originating midway between snout-tip and caudal base, separated by an interspace, not quite reaching anal fin origin. Scales lateral 38 to 40, several more on caudal base, 11 transverse from dorsal to pelvics. Scale-nucleus centred, edge apically rounded, basally truncate. Concentric striæ meeting at obtuse angles in a line from nucleus apicad.

* 'Fish Culturist,' Philadelphia, iv. 1925, p. 371.

Basal radii about 15, none complete. Apical radii few or absent.

General appearance somewhat similar to that of *Zygonectes dispar*. Yellowish brown above, light below. Each scale-row with a series of brown spots, one to a scale, forming longitudinal lines, the line of every other row more or less imperfect. Dorsal, anal, and caudal speckled with brown. Up to 46 mm. (58 mm. with caudal).

Porto Nacional, Rio Tocantins, Goyaz, Brazil (Donna Franciquinha, shallow lake, into Riberão, into Tocantins) (*Dr. Carl Ternetz*, Feb. 16, 1924).

The coloration is a duplication of that of *Rivulichthys rondoni*, *Neofundulus paraguayensis*, and *Rivulus rogoaguæ*. It is interesting that these four species, of as many genera, from the general region of southern Brazil, should have the same coloration. A similar coloration, distributed through several genera, is seen in the Characine *Pseudochalceus affinis*, *Hollandichthys multifasciatus*, *Entomolepis steindachneri*, *Astyanax lineatus*, and *Mœnkhausia latissima*.

Rivulus balzanii (Perugia) (Regan, 1912, p. 504) probably belongs in this genus or in *Rivulichthys*. It may be identical with *R. rondoni*. It cannot be placed from the original description, but the depth indicates that it is not a *Rivulus*.

X.—*A new Subgenus of* Ligia, *with further Observations on the Genus*. By Harold G. Jackson, D.Sc., Birkbeck College, University of London.

[Plate II.]

Contents.

1. Description of Material.

The genus *Ligia* has, up to the present, presented the picture of a harmonious assemblage of Terrestrial Isopods into which the subgeneric apple of discord has yet to be

thrown. Recently some material sent by Dr. C. L. Withycombe from Trinidad was given to me for description by the kindness of Dr. W. T. Calman, F.R.S., and it contained nine specimens of a *Ligia*-like Isopod which there is no choice but to recognize as standing sufficiently apart from other species of *Ligia* to necessitate the creation of a subgenus for its reception. A description of the specimens will be found below, following which the genus *Ligia* is discussed and redefined.

Ligia (*Pogonoligia* *) *muscorum*, subgen. et sp. n.

Male and female specimens examined.

Length, ♂ 7·5 mm., ♀ 9·5 mm.; *breadth*, ♂ 3·5 mm., ♀ 4 mm.

Shape oblong-oval. *Surface* smooth and shining, not at all granulate.

Head †. Eyes very large, fully one-half upper surface; passing forwards and downwards on both sides over profrons to reach supra-antennal line, attaining posterior margin on both sides and drawn back so that upper surface of head appears bean-shaped. Lateral lobes absent. Median lobe absent. Occipital groove only visible on dorsal surface in middle portion, being masked by backwardly projected eyes. Post-orbital pits very shallow and almost obsolete. Marginal line skirts eyes laterally and runs forwards over antennary tubercle to fall vertically to maxillary bar. Interocular line absent. Frontal line truncated at each end at margin of eyes, arcuate from above and forming forward margin of bulbous projection formed by profrons. Supra-antennal line low on face, constricting postfrontal area, lateral termination on antennary tubercle over vertical portion of marginal line. Frontal lamina smooth and scarcely projecting from face, frontal spine narrow and almost obsolete, so that antennular sockets approximate closely. Clypeus not projecting, smooth, lateral processes small; confluent with labrum, the line of fusion marked by shallow depression. Gena bulbous over mandible, deeply sunken behind, so that eyes project laterally as on a shelf; genal groove deep, genal fossa almost obliterated, lower edge of postgena

* *Ligia* is so far from her classical prototype in other characteristics that it seems small violence to endow her with a beard.

† The nomenclature employed is that proposed by the author in 'The Morphology of the Isopod Head,' 1926.

scarcely lower than mandible. Maxillipedal somite clearly demarcated and carried to lower edge of postgena.

Thorax. Hind border of first three somites transverse, remainder progressively more curved, postero-lateral angles little drawn out. Coxal plates not marked on male; separate on 4, 5, and 6, and barely visible on 3 and 7 on female.

Abdomen. Not abruptly contracted. Postero-lateral angles of 3, 4, and 5 drawn sharply back, telson + sixth long and broad; well-marked shallow groove separating anterior three-quarters from posterior quarter, possibly delimiting telson from sixth somite; hind border widely crenulate and emarginate, postero-lateral angles absent, single blunt accessory process over each uropod, median spine absent but two subacute processes present on either side of mid-line.

Appendages. Antennula small; third segment not vestigial, about $\frac{1}{3}$ second, provided with apical sensory setæ. *Antenna* long and slender; proportion to body, ♂ $\frac{6}{7\cdot5}$, ♀ $\frac{6\cdot5}{9\cdot5}$, in male may exceed in length the thorax, in female may equal it in length; fifth segment slender, flagellum 14–16 segments.

Mandibles. Right with incisor process of three teeth, lacinia mobilis weak and of two teeth, one large and densely setose plume, penicilli absent; left with incisor process of three teeth, strongly chitinized but small lacinia mobilis of three teeth, one large and densely setose plume, penicilli absent.

Maxillula. Outer endite 5 + 4 (group of five long and strongly chitinized, three outer of remainder deeply serrate); no fine plumose setæ, a subapical (but lateral) dense brush of very long curved setæ; basis clearly defined from endite: inner endite with lobate densely setose apex and laciniate outer edge; plumes elongate, acute, setose on distal side.

Maxilla. Outer endite small but well separated, sensory setæ at apex; inner endite moderately setose, sensory brush setæ above fossa for insertion of adductors.

Maxillipede. Endopodite of great length, segments completely separated, considerably longer than basis; endite distally rectangular, distal border spiny and with row of six flat shield-like setæ, no setose plumes.

Peræopoda typical of the genus, without distinguishing male and female characters, and uniform throughout.

Pleopoda typical of the genus in both sexes.

Uropod. Protopod long and moderately slender (longer than median length of telson), outer and inner lateral carinæ, sharp terminal lateral spine; exopod long, styliform,

slightly shorter than endopod; endopod long, styliform, and equal in length to first four thoracic somites: proportion of whole to body, ♂ $\frac{3\cdot5}{7\cdot5}$, ♀ $\frac{5\cdot0}{9\cdot5}$.

Colour (in spirit) light brown on white background, coxal plates lighter than terga, darker median line, underside white and only speckled, flagellum and rami of uropod horny-brown. Collector's note:—"Isopods with pale lateral margins had dark brown terga with blue spots and dark brownish eyes. Colours fade at once—locally common."

Occurrence. "In moss under Matacas Waterfall, Trinidad, 14. ii. 26."

2. The Systematic Position of *Pogonoligia*.

A comparative review of the characters of this animal provides the following data:—

In general body-form, appearance, and size it is absolutely typical. The head with the enormous eyes widely projecting over the sunken genæ and the constricted frontal region is paralleled in four other species—*L. italica*, *gracilipes*, *perkinsi*, and *exotica*,—but the characters are more exaggerated than in these, and the complete fusion of the clypeus and labrum is unique. There is nothing notable in the thorax and abdomen until we reach the last somite of the body. In these specimens this is very long and a distinct groove passes across it, separating the anterior three-quarters from the posterior quarter. The anus opens underneath the posterior quarter and the uropods are attached to the anterior three-quarters, so it is reasonable to assume that the groove represents the line of fusion between telson and sixth somite. Apart from the Anthuridæ, in which the telson is separate, I do not know of a similar instance in the Order. The crenulate and emarginate hind border of the telson does not conform with either the arcuate or acute character by which I found it convenient to distinguish the other species of *Ligia* (1922).

The appendages present many points of divergence from the typical *Ligia*. The third segment of the antennula is proportionally very much longer than in any other *Ligia*. The mandibles are alone in the absence of penicilli behind the large setose plume; the lacinia mobilis is peculiar in the paucity of teeth on both sides. The maxillula is marked off by the curious dense brush of long setæ, prominent externally, on the outer endite. The small teeth of this endite are

ctenate in common with the majority of the species of *Ligia*, and even in those species which usually have simple teeth (*L. oceanica*, *cinerascens*, *occidentalis*, and *pallasii*) a tendency towards serration constantly appears*. The inner endite at first sight appears to have the sensational armature of four plumes, but a close examination shows the distal plume to be an unjointed prolongation of the axis. This feature is peculiar to these specimens, although several species have a setose termination to the endite. The blade-like expanded outer edge is found in several species in a lesser degree. The maxilla conforms to the most common condition in being without two setose bristles on the medial edge. These were considered by Sars to be characteristic of the *Ligiæ*, but are, in fact, only possessed by *L. oceanica*, *pallasii*, and *cinerascens*, and the genus *Ligidium*. The inner endite is unusually sharply defined from the outer, and both are richly supplied with sensory bristles.

The maxillipede is most characteristic, with its large well-developed endopodite and large endite bearing characteristic scale-setæ.

To sum up, one may say that these specimens differ from all other species of *Ligia* in the following fundamental points, which seem to me inevitably to place them apart from the remainder:—(1) The antennula; (2) absence of penicilli on the mandible; (3) the brush and accessory setose knob on the maxillula; (4) the maxillipede; (5) the formation of the telson.

I therefore propose the following emendation of Sars's definition of the genus *Ligia* (1899) with definitions of the subgenera *Ligia* (*Ligia*) and *Ligia* (*Pogonoligia*).

Genus Ligia, Fabricius, 1798.

Body regularly oval or oblong-oval, moderately convex above, metasome confluent with mesosome or abruptly contracted. Head with occipital groove not obscured above by occiput, supra-antennal and frontal lines both present. Eyes large and convex. Antennulæ small, last segment small or vestigial. Antennæ strong, elongated. Mandible with a setose plume behind the lacinia mobilis and usually numerous penicilli between it and the molar process. Maxillipedes comparatively short and stout, endopodite large, five distinct or indicated segments, endite large, epipodite rounded.

* An excellent summary of the mouth-parts of *Ligia* by Panning (1921) fills to a great extent a gap in my revision (1922).

Subgenus LIGIA, nov.

Last segment of antennula rudimentary, nodiform. Mandible with small setose plume and numerous penicilli. Maxillula not provided with setal brush on outer endite or setose knob on inner endite. Endopod of maxillipede shorter than basis. Telson arcuate or acute, not defined from sixth somite.

Subgenus POGONOLIGIA, nov.

Last segment of antennula nearly half as long as second. Mandible with large setose plume, penicilli absent. Maxillula with subterminal dense setal brush on outer endite and terminal setose knob on inner endite. Endopod of maxillipede large and markedly longer than basis. Telson emarginate and distinctly marked off from sixth somite.

The subgenus *Pogonoligia* is created for the reception of *Pogonoligia muscorum* described above; the subgenus *Ligia* contains the species of *Ligia* hitherto described.

3. *LIGIA EXOTICA* AND *L. PERKINSI*.

The genus *Geoligia* established by Dollfus in 1893 was disallowed by both Chilton and myself working independently in 1921 on different material. Chilton's material came from the type-locality, mine was Dollfus's type-material in the British Museum. Although in agreement over the invalidity of Dollfus's genus, our conclusions as to the validity of his species were different. Chilton identified his type-locality specimens as *L. exotica*, a species also common enough on the sea-shore beneath, and was naturally led to conclude that *G. perkinsi* was a synonym of *L. exotica*. My examination of the type-specimens left no doubt in my mind that the *species* was good, even though the genus undoubtedly was not. As Chilton returned to the subject in a later paper (1924) and did me the kindness to give weight to my less experienced judgment, I have re-examined Dollfus's five specimens (1 ♂, 4 ♀) and compared them with a large number of specimens of *L. exotica* from various localities throughout its distribution, and hope to be able to show in the following table that he was certainly justified in creating a new species, although his genus is quite indefensible. At the same time I gladly accept Chilton's suggestion that the probable derivation of the species is from *L. exotica* and not from

L. hawaiensis as suggested by me. The chief points in which the species differ can be thus set out:—

L. exotica.	*L. perkinsi.*
1. Surface moderately rough and granulate.	1. Surface almost smooth.
2. Coxal plates often distinctly marked on all thoracic somites in both sexes.	2. Coxal plates show no trace of division except on 2, 3, and 4 thoracic somites of female.
3. Telson with very acute and drawn out median spine and accessory processes.	3. Telson with both processes blunt.
4. First peræopod of male with prominent process on propos.	4. First peræopod of male without a process.
5. Maxillula (outer endite) with long and slender, terminal, very finely serrate, inner teeth and long delicate plumose seta.	5. Maxillula (outer endite) with shorter and more denticulate teeth and without long plumose seta.
6. Mandible with very numerous penicilli.	6. Mandible with few penicilli.

These characters, which are common to all Dollfus's specimens, seem to me sufficient to maintain the independence of the species.

The conclusions to be arrived at can be thus stated:—

1. *Ligia exotica* has in the past extended its range inland to considerable altitudes and still does so.

2. A new form (*L. perkinsi*), which can rank as a distinct species, has arisen from it in the Hawaiian Islands and exists side by side with it.

3. The differences are not due to confusion between growth-stages of the two forms or to sexual modifications.

4. The questions awaiting solution are:—Has *L. perkinsi* arisen from *L. exotica* as a mutant, or is there a series of intergrading forms? Are there differences in habits between the two species which could have produced, encouraged, or permitted the change from one to the other? It is to be hoped that a further careful study of the locality will furnish definite evidence on these important points.

NOTE.—Since the above was set in type I have received three specimens (1 ♂, 2 ♀) of *Ligia perkinsi*, identical in every particular with those described above, from Namua, Samoan Islands, collected by Buxton and Hopkins on rocks on the shore. This unexpectedly wide distribution raises questions which must be dealt with elsewhere.

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EXPLANATION OF PLATE II.

Fig. 1. *Pogonoligia muscorum* from dorsal aspect.
Fig. 2. Head from front. *clp.* = clypeus; *fr.* = frontal line; *fr.l.* = frontal lamina; *lb.* = labrum; *mnd.* = mandible; *pf.* = profrons; *ptf.* = postfrons.
Fig. 3. Head from side. *g.* = gena; *gg.* = genal groove; *og.* = occipital groove; *pg.* = postgena.
Fig. 4. Antennula.
Fig. 5. Left mandible. The molar process is not shown.
Fig. 6. Right mandible. The molar process is not shown.
Fig. 7. Left maxillula from above (anterior face).
Fig. 8. Maxillula, outer endite, enlarged distal end.
Fig. 9. Maxillula, inner endite, enlarged distal end.
Fig. 10. Left maxilla from above (anterior face). The tip of the outer endite and the spines on the inner border shown enlarged.
Fig. 11. Left maxillipede from above (anterior face).
Fig. 12. Seventh peræopod, dactyl enlarged.
Fig. 13. Second left pleopod, ♂ from above (posterior face).
Fig. 14. First left pleopod, ♂ exopod, from above (posterior face).
Fig. 15. First left pleopod, ♂ endopod, from above (posterior face).
Fig. 16. First left pleopod, ♀ exopod, from above (posterior face).
Fig. 17. Second left pleopod, ♀ exopod, from above (posterior face).
Fig. 18. Sixth somite and telson from above.

XI.—*On an undescribed Fossil Species of the Genus* Viviparus, *Montf., from the Neogen Deposits of Yugo-Slavia.*

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[Plate III.]

IN the unnamed collections of the Geological Department of the British Museum (Natural History), South Kensington, London, Mr. L. R. Cox, in charge of the fossil Mollusca in the institution, showed me a beautiful series of a Viviparid collected from the Neogen Deposits of Yugo-Slavia. He

believed the species to be new, and generously left me to work it up. On going through the literature I found that the fossils, as Mr. Cox believed, belonged to a new species. I propose the name *Viviparus coxi* for this interesting species as a slight token of my gratitude for the help Mr. Cox gave me during the time I was working on the fossil Viviparidæ in the collection of the British Museum.

Viviparus coxi, sp. n.

The species is of a medium size, the largest specimen of the series not exceeding 26 mm. in total length. The shell is subpyramidal-conical, solid, and has the surface covered with minute oblique ridges running from in front backwards. It consists of $5\frac{1}{2}$–6 whorls. The spire is elongate. The suture, which is oblique, is fairly impressed. The whorls are a little oblique, not greatly swollen, and increase gradually in size. The body-whorl, as seen in dorsal view, is broadly band-shaped, increasing slowly towards the end; it is not very swollen. The aperture is ovoid, slightly pointed posteriorly, and, in spite of the ridges on the shell, may be described as continuous. The shell is subumbilicate, and the columellar callus is not very prominent. The sculpture, which is very characteristic, consists of three very marked and almost equally developed spiral ridges or keels corresponding to the three ridges of the embryonic shell. The shell-surface in between the keels is quite flat. The ridges are equally prominent on all the whorls, but in the case of the earlier whorls the peripheral becomes covered by the succeeding whorls and only the sutural and the median ridges are visible. Below the peripheral and running spirally there are three or four rather low secondary ridges on the under surface of the body-whorl. The keels are all solid, and only rarely show uneven development, when they become rather wavy. The shells are milk-white to bluish in colour.

Measurements of Shells (in millimetres).

Total length	26·5	21·8	25·2	22·8
Maximum diameter	17·2	14·8	16·1	15·7
Height of aperture	12·8	10·7	12·4	12·1
Maximum diameter of aperture ..	9·6	8·4	9·2	9·1

Locality.—A good series of this interesting species collected from the Neogen (probably Pliocene) Deposits of Skoplje, near Obilie Station, on Mitrovitsa Railway, Yugo-Slavia, on 25th May, 1924, was presented to the British Museum by Mr. Franklin White, the collector. The shells are beautifully

preserved, and, according to the collector, were set free from the upper band of Lignite in the area by the effect of rain.

Holotype No. G. 32996 and Paratypes G. 32997–99, in the collections of the Geological Department of the British Museum, London.

Relationships.—*V. coxi* represents a very rare type of the Levantine Viviparids of Eastern Europe. In this group all the three primary ridges of the embryonic shell are preserved on the adult shell. It is closely allied to *V. viquesneli* (Deshayes*), from Ipek or Pec Beds, and supplies an interesting link between *V. d'archiaci*, Pavlović†, and the Deshayesian species.

EXPLANATION OF PLATE III.

Direct natural-size photographs of the dorsal and ventral views of two shells of *V. coxi*, sp. n., the larger specimen represents the Holotype of the species.

XII.—*A new Form of Water-Vole from Daghestan (East Caucasus)*. By S. I. Ognev and A. N. Formosov.

Arvicola amphibius djukovi, subsp. n.

Type-specimen.—No. 15, Collection of S. I. Ognev, ♂ ad., 12. viii. 1924, Kumalu district, Kasikumuch, Lack district, Mountains of Daghestan. Three specimens besides the type from the same district.

Diagnosis.—Is closely related to *A. amphibius meridionalis*, Ognev, but can, on the whole, be easily distinguished by its lighter colouring, where a bright rusty-yellow predominates. The præmaxillare processes in the region contiguous with the frontalia do not project beyond the outline of the ossa nasalia at the back.

Measurements.—Length of body and head from 162 to 224 mm.; tail from 79 to 104 mm.; sole from 26 to 30 mm.; ear from 13 to 15 mm.; general length of skull 36·4 to 43·8 mm.; breadth of cheek-bones 21·8 to 26·6 mm.; length of upper molar row from 8·7 to 9·6 mm.

* Deshayes, G. B., Mém. Soc. Géol. France, (ser. i.) v. p. 88, pl. xx. fig. 7 (1842).

† Pavlović, P. S., Mem. Geol. Penin. Balkan, Belgrade, vi. p. 594, pl. ii. figs. 11–13 (separate in 1908).

Description of the Type.—Colouring rather light, much more so than in *A. terrestris* and *A. amphibius meridionalis*, Ogn. A bright rusty-yellow tone predominates very visibly in the colouring of the upper part of the body as well as in that of the belly; it is especially marked upon the sides. The dense and luxurious fur on the back is snuff-brown with a tawny-olive tint—these colours being at the same time strongly overlaid by an admixture of blackish tint. Lower down the brownish tint gradually disappears, the sides upon their entire length becoming a tint intermediate between cinnamon and pinkish cinnamon. A broad cinnamon belt stretches across the middle of the belly, a somewhat less coloured pectoral spot extending forwards from it like a diffusing stripe. The region of the throat, the arm-pits, and the rump are of a pale neutral grey slightly diffused by a rusty tinge. There are rusty spots on the cheeks and round the aperture of the anus. The tail is much darker than the body, and is covered by blackish-brown hairs; at its base and especially underneath it there is a sprinkling of tawny-grey hairs. The feet are covered above by hairs of a light pinkish-cinnamon tone sprinkled with grey; the claws are whitish, the vibrissæ are black with whitish tips. The colouring of the other specimens agrees with this description of the type.

Skull.—By its size and shape it is like those of *A. meridionalis* from the Northern Caucasus, but it differs by the following characters: the præmaxillar processes do not project beyond the posterior end of the nasalia in the region contiguous with the frontalia (in *A. meridionalis* they project far beyond their extremities); the upper incisors descend less abruptly and project more forwards—their enamel is of an ochreous-buff colour in front, in the proximal part of the tooth, and pure white at the ends. The incisors of the lower jaw are, on the contrary, comparatively paler coloured; they are warm buff at the base and pure white like the upper ones at the ends.

The form we describe is easily distinguished from *A. amphibius meridionalis*, Ognev, by its markedly lighter colouring and by the characters of the skull that have been enumerated. From *A. amphibius rufescens*, Satun., it differs by its larger dimensions (the usual length of skull in the latter species is 34·2 to 33·2 mm.) and by the lighter colouring of the belly; from *A. amphibius persicus*, de Fil., by the intensity of the rusty tints of colouring upon the upper part of the body and by the comparatively dark colouring below, as well as by its large size and short tail (the tail of *A. persicus*

measures from 104 to 138 mm.). Lastly, our water-voles differ from *A. amphibius armenius* by their greater size, shorter tail, and by the shape of the teeth, which have, as we know, strongly rounded, almost round, prism angles in the former species. Our specimens present some particularities of colouring. The basal parts of the hairs on the back are of a deep blackish-slate colour and occupy relatively broad bands; the tips of the hairs are cinnamon or even cinnamon-buff; in the hairs so coloured there is a considerable admixture of bristles of greater length, which have brilliantly black tips and no lighter-coloured bands at all. These hairs produce a certain darkening in the general tint of the fur. On the sides of the body the black hairs disappear and, therefore, the cinnamon tints are brighter and more distinct here. The basal parts of the hair on the belly are lighter coloured than on the back and in general are of a grey colour.

The distribution of the Caucasian water-voles is very insufficiently known at present. Apparently the region of the plains, to the north of the principal mountain range of the Caucasus, is inhabited only by one form, *Arvicola amphibius meridionalis*, Ognev, described at first from a region situated close to the river Oural. Later on this form was found in the Government of Astrakhan and in Northern Caucasus along the course of the river Terek. It is probably the same as the one living in the reeds on the shores of the Caspian Sea, near the mouth of the Sulak, and along the river Kuban. *Arvicola amphibius persicus*, de Fil., occupies the north-eastern angle of Persia; it was found within the former Russian boundaries on the West Transcaucasian plateau, in the province of Kars, at an altitude of 6600 feet, and in the Government of Erivan. Satunin supposes that it may be found in the western part of the Government of Tiflis. In Armenia and the north-west of Persia, at an altitude of 5000–9000 feet, lives *Arvicola amphibius armenius*, described by O. Thomas.

What is the form of water-vole peculiar to Eastern Transcaucasia has not yet been elucidated. We also know but little about these small animals which dwell in the mountainous part of the Caucasus, where, to judge by existing data, they present many minute races. For instance, the high alpine meadows of Karatchai, North-west Caucasus, are inhabited by *A. amphibius rufescens*, Satun.; on the slopes of the Shakhdagh and the Shalbusdagh, at an altitude of about 8000 feet (mountains of South Daghestan, Samur district), lives *A. amphibius kurushi*, lately discovered by

A. Formosov and Heptner. It will be described in the results of the Daghestan Zoological Expedition. Lastly, *A. amphibius djukovi*, described in this paper, belongs to Middle Daghestan.

There is no doubt that a further study of the Caucasus fauna will make it necessary to establish a whole new series of high-mountain forms also belonging to this genus.

Zoological Museum, Moscow University,
March 1926.

XIII.—*A new Subspecies of Hamster from Daghestan* (Mesocricetus raddei, *Nehr.*), *and some Remarks on the Russian Species of* Mesocricetus (*with a Key to them*). By S. I. Ognev and W. G. Heptner.

In 1894 A. Nehring described *, from a single specimen procured by Radde near the sources of the river Samur (Caucasus, Daghestan), in June 1886, a new form of blackish hamster, naming it *Cricetus nigricans*, Brandt, var. *raddei*. Later on †, this author, after studying the same specimen more minutely, did not any longer consider this form a variety, as at first, but was inclined to admit its being a different species, naming it *Mesocricetus raddei*, sp. n. In the latter, as well as in the former, article, the skull only was described and its characters alone were given, as differentiating *M. raddei* from the closely allied *M. nigriculus*, Nehr., of Northern Caucasus. According to the author, the original specimen was in such an imperfect state of preservation (having lost its colour in alcohol) that he did not describe the colouring at all. The deficiency was filled up in the detailed work of Nehring on the genus (subgenus) *Mesocricetus* ‡; but the description given was from two other skins received from the Russian zoologist K. A. Satunin, who had taken them on August 23rd, 1897, upon the Khunsakh plateau in Western Daghestan, that is at no small distance from the spot whence the type of species had come. In the same article two skulls of *M. raddei* are reproduced, that of a comparatively young type from the

* 'Zoologischer Anzeiger,' No. 445, 1894, p. 148.

† *Op. cit.* No. 553, 1898, p. 182, "*Cricetus raddei*, sp. n."

‡ 'Archiv fur Naturgeschichte,' 1898, p. 373, "Die Gruppe der *Mesocricetus*, Arten."

Samur and of an old individual from the Khunsakh plateau. The study of the series of *Mesocricetus raddei* from Khunsakh * (collections of S. I. Ognev and of the Daghestan Zoological Expedition) and from other places in Daghestan, where this small hamster, as well as the topotype of the sources of the Samur, was only recently discovered, owing to the unflagging energy of N. N. Djukov, has enabled us to bring to light some interesting facts :—

First of all, that this species, whose habitat was thought to be limited to a surface of only a few square versts on the Khunsakh plateau, occupies a region of much greater extent. Further, it enabled us to establish that *M. raddei*, in the whole area of its distribution in the mountains of Daghestan, is not monotypic, but forms two distinct groups. One of them occupies the Khunsahk plateau, the other extends further east. Also that the specimens, collected by N. N. Djukov in Eastern Daghestan (see below), are markedly alike. The description as well as the distinctive characters of the new subspecies are given farther on ; here it is only worth noting that Nehring has described and figured, under the name of *M. raddei*, two different races of one species. Nehring's first description having been very schematic and unsatisfactory, it was, as it were, forgotten, and his succeeding one, where the skulls and skins of adult *M. raddei* from Khunsakh are minutely described, was accepted as an authority. Thus it became a fixed opinion in zoological literature that Khunsakh was the *terra typica* of this species—Satunin, Radde, and others wrote in this sense. In this way it turned out that the old classical habitat, where this species was always taken, is inhabited by a new form, whilst the newly discovered interesting places of habitat are taken up by the typical *M. raddei raddei.* After these preliminary considerations we pass on to the description of the new form.

Mesocricetus raddei avaricus †, subsp. n., typus ♀ sen.

Near the (village) aoul Khunsakh, Avarsky district. Province of Daghestan, 5530 feet alt., 23. vii. 24. Collection of the Zoological Museum of the Moscow University, No. S. 4520, leg. D. Behme.

Diagnosis.—This subspecies resembles *Mesocricetus raddei*

* The topotype material which has served to describe the colouring in the original work.

† Named after the tribe of the Avarci which inhabit this country, called Avaria by the natives, and which belongs to the Avarsky district of the Daghestan province.

raddei, Nehr., but differs from it by the colouring of the belly, which is quite black and not greyish, by the zygomatic arches narrowing in front and being slightly compressed, and by the distinctly projecting forward ossa nasalia. The rostrum cranii is somewhat lighter and narrower. Length of body up to 220 mm.; length of skull 46·7 mm.; breadth of zygomatic arches up to 25·1 mm.; the alveolar length of the upper molars 8·2 mm.

Comparative Remarks.—This new form of hamster, though very near to the typical *M. raddei raddei*, differs from it by the following characters:—

Skull.—A comparison between specimens of the two races (see measurement table) makes it evident that, on the whole, the skull of the new form is somewhat smaller in size and possesses some peculiarities of structure. The brain-case is smaller and narrower. The ossa nasalia of *M. raddei avaricus* are slightly compressed in the middle third of their length, and the outward line of the sides is gently undulated. The front part of the lateral limit of the ossa nasalia is a little rounded inwards, while the foremost extremities of these bones are visibly elongated and pointed. In *M. raddei raddei* the shape of the ossa nasalia is different, their lateral limit-line is a straighter one, the compression in the middle is scarcely perceptible, and there is no narrowing of the bones towards the front. They have an almost regular wedge-shaped appearance. Besides, the nasalia are obtuse in front and do not project forward as strongly as in *M. raddei avaricus*, subsp. n. The posterior limit of the ossa nasalia in this last species is generally more acute. Some differences in the structure of the rostrii cranii attract attention: if we look down upon the skull, we see that the rostrum of *M. raddei avaricus* is, on the whole, less broad and becomes narrower towards the front. The typical form has a broader and heavier rostrum that does not narrow forwards, and which looks as if it were chopped off. The outline of the rostrum is likewise different in each form; it is massive, with a straight upper margin in *M. raddei raddei*, whilst in *M. raddei avaricus* it is visibly slighter, the anterior part of the upper margin perceptibly slanting downwards, producing thus a strongly inclined profile. It is to be noticed that the os interparietale is shorter and somewhat broader in *M. raddei avaricus*.

The difference is especially striking in the shape of the zygomatic arches. Those of *M. raddei avaricus* diverge, slanting backwards, becoming narrower towards the front, and, as it were, forming the figure of a triangle. Those of

M. raddei raddei present a figure resembling a quadrangle. The processi zygomatici os. maxill. strongly diverge sideways, forming, midway in their course, an obtuse angle directed backwards. Owing to this, the middle part of the whole zygomatic arch in *M. raddei raddei* is more on a parallel with the longitudinal cranium axis than in *M. raddei avaricus*. Except this, the general disposition of the zygomatic arches is rather broader and the basis of the processus zygom. os. maxill., if looked at from the front, appears more massive.

All the characters here enumerated are well demonstrated in the figures and by the table of measurements. As a conclusion, it must be remarked that the skull of very aged specimens of *M. raddei avaricus* appear lighter than in the typical form.

The colouring in our series of the two forms under comparison shows rather strong variations (individual and seasonal). Thus, towards autumn, the fur grows longer, more dense, and, so it seems, in a certain degree darker in colour. The differences of the fur-colouring, although they are easily noticeable, cannot be said to be thoroughly constant, so that we do not attribute to them the significance of fundamental characters.

Mesocricetus raddei avaricus is generally of a light and yellowish colour above, the typical form being darker and more blackish. This general darker colouring of the upper part of the body may be explained by the joint action of the following causes: the presence of black tips on the soft under-fur, which is less developed in *M. raddei avaricus*; the greater number of perfectly black hairs, which, to a certain amount, exist in all the forms of the genus (in *M. raddei raddei* the yellow band on the hair is narrower, and therefore the darker shades of colouring predominate upon it *). The difference of intensity of the rusty tints upon the muzzle in the two subspecies is an insignificant one. In the typical form the yellow-tinted surfaces around and between the eyes, on the cheeks and forehead, are a little darker with a brownish tinge, whereas in *M. raddei avaricus* these parts are more yellowish †, this being the more frequent colour of this form. The colouring of the underpart

* The hair consists of the following coloured bands:—The lowest, taking up about three-fourths of the total length, is of a colour approaching a "dark mouse-grey," and the tip, for one-fourth of the length, somewhat duskier than a "buckthorn-brown" colouring. Sometimes there is a small black tip.

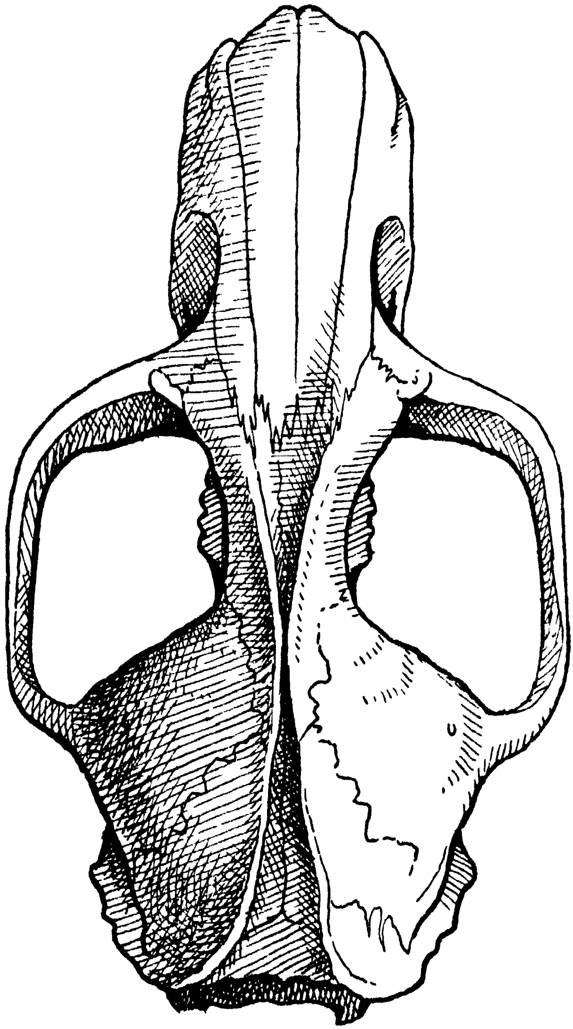
† In both forms the general colouring approaches a "cinnamon" colour.

of the body, of the breast and belly, gives good characteristics. In *M. raddei avaricus* the whole neck, the breast, and the belly, as far as the root of the tail, are a pure black, especially bright and intense upon the pectoral region, between the fore-feet. The colour in *M. raddei* is pure black, almost the same as in the form *M. avaricus*, only sometimes the breast-spot has a dirtier tinge. All the region of the belly has a much lighter colouring than in *M. raddei avaricus*, and is of a greyish milky white. The colouring of this part of the body of some specimens is very like that of the lower sides. Especially the specimen from the Upper Samur (Rutul) is very lightly coloured below.

In this way the contrast between the colouring of the breast and that of the belly, perfectly evident in that of *M. raddei raddei*, is scarcely noticeable in the new form. It is useful to note that in *M. raddei avaricus* there are sometimes, on the dark background of the lower part of the body, irregular white spots as large as 1 cm. These spots are most often found in the typical form. Whatever the age, the characteristic colouring of the lower part of the body is very marked : the contrast between the colour of the breast and that of the belly is very evident in *M. raddei raddei* when very young. As far as one can judge from our series of specimens, the dimensions of the body in *M. raddei avaricus* are smaller than those of the typical form. In conclusion, it must be remarked that the skulls of the two different races are represented, in the above referred to fundamental work of Nehring, under the general name of *M. raddei*, Nehr., that of a young *M. raddei raddei* of the Samur type, and that of an adult *M. raddei avaricus* from Khunsakh.

The error of Nehring is easy to understand, as he had only three specimens of different ages, insufficient material to judge by accurately. The young specimen represented by Nehring belongs to the form with broad zygomatic arches, and has nothing to distinguish it from our Samur specimen of the same age.

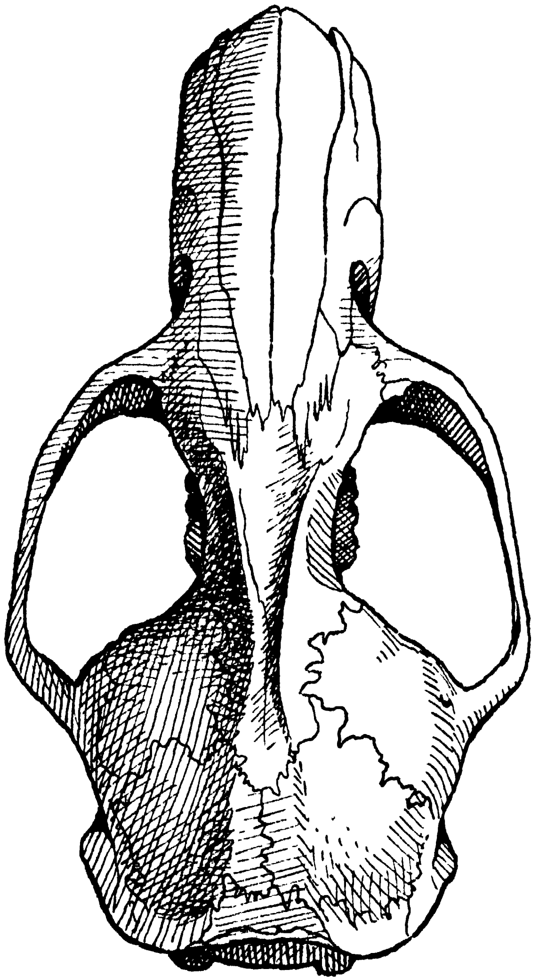
Geographical Distribution.—*Mesocricetus raddei raddei* lives along the upper course of the Samur aoul Rutul, near its sources, a little below the confluence of Samur proper with Karasamur and, it may be, the aoul Akhty, where the river of that name joins the Samur. Further, it has been found in the aoul Tchirakh, situated at the sources of the river Kurakh-tchai, which, under the name of Ghul-gyari-tchai, flows into the Caspian Sea not far from the mouth of the Samur. More to the west, already beyond the mountain ridges, in the basin of the Sulak, the river which is the main



I.

Mesocricetus raddei raddei, Nehr.

♂ sen. Aoul Kosrek on the Kokma-tchai sources of the Koi-sou of the Kasi-kumukh, Lack circuit, Daghestan, 16. x. 1924, N. N Djukov leg., No. M. 29. Collection of S. I. Ognev.



II.

Mesocricetus raddei avaricus, Ogn. et Heptn.

Typus ♀ sen. Aoul Khunsakh on the Avarsky Kio-sou (5558 feet alt.). Behme leg., No. S. 4520. Collection of the Zoological Museum of the Moscow University.

artery of Daghestan, the typical form has been found in the following places: the sources of the Kasikumuk-koi-sou, the most eastern of the Sulak's affluents; the aoul Khosrek on the river Kokmatchai and the aoul Djaafaralmakhi, situated between the rivers Kokmatchai and Arzapanek. The same form has also been taken at the aoul Kumalou, not far from the large village of Khoumouk on the middle course of the Koi-Sou of Kasi-Kumukh. In short, this race is found near the sources of the rivers in the basin of the Samur and near those of the Kasikumukh-koi-sou, viz., in the mountainous part of the Kasikumukh (Lack) and Samur districts of Daghestan. We find it difficult to give the exact altitude above the sea-level, but it is certainly not below 5000 feet.

Upon this limited territory this little hamster is not numerous, living in the vicinity of cultivated places. More restricted still is the extension range of *M. raddei avaricus*. So far this form has only been known out of the neighbourhood of the aoul and the fortress of Khunsakh, situated further west on the river Avarsky Koi-sou.

The species we are describing is found here in considerable numbers upon a plateau of several square versts of 5530 feet above the sea-level, where it injures the crops so visibly that it has to be controlled. Such seemingly strange extension ranges of the different forms must not make us wonder, as we have to deal with a very peculiar and complicated mountainous region. From the allied species, nearest to it by their geographical distribution, *M. raddei* seems to be sharply isolated. On the south, the high ranges of the principal mountain-chain of the Caucasus and its ramifications into the government of Tiflis cut it off from the Transcaucasian *M. brandti*, Nehr. On the north it is separated from the *M. nigriculus* of the plains, a species extending only to Khassav-Jurth eastwards, by a wide stretch of typical barren Daghestan hill-ranges and by the belt of the lowest mountains.

The Caucasian representatives of the genus *Mesocricetus* may be divided into two groups. The Transcaucasian, comparatively small species, with a light colouring of the belly, *M. koenigi* and *M. brandti*, and the North Caucasian *M. raddei* and *M. nigriculus* with a dark belly. Externally the two last species appear very much like one another, but in reality it is impossible to confound them. The most marked difference is that in size, the comparison being made, of course, between specimens of the same age. It must be remarked

that *M. nigriculus*, by several features in the structure of the skull, is nearer to *M. raddei raddei* than to *M. raddei avaricus*. In the species of the plains, the outline of the zygomatic arches is somewhat widened and the rostrum is also rather massive in shape. This only concerns the shape and nowise the size of the skull. The points of difference between the nearest forms are given in the dichotomous table, which, as compared to the former ones, has been extended and completed (corrected and improved) in accordance with new data. For the sake of completeness, *M. eversmanni* and *M. microdon* have been included in it. The latter species has been described recently (1925) by S. I. Ognev from one specimen. Some time ago the Academy of Sciences of St. Petersburg has received several specimens of this curious form, obtained from a locality close to the one where the type was discovered.

Key to the Russian Representatives of the Genus Mesocricetus, *Nehr.* (1898).

I. Belly dark—black or blackish; a black spot on the breast. Difference of colouring between the breast and belly insignificant or imperceptible.

a. Length of body in adult or older animals up to 280 mm. Greatest length of skull 50·5 mm. Zygomatic width up to 27·0 mm. Alveolar length of the row of upper molars up to 8·6 mm. .... *M. raddei*, consp.

b. The zygomatic arches wider in the anterior part. The ossa nasalia straightish, broad and blunt in front. Breast-spot brilliant black, belly dark grey, sometimes only grey. .... *M. raddei raddei*, [Nehr., 1894.

b'. The zygomatic arches narrowed forwards in the anterior part. Ossa nasalia slightly compressed in the middle, visibly projecting in front, and somewhat pointed. The breast-spot pure black, the belly dull black.. *M. raddei avaricus*, [Ogn. et Heptn.

a'. Length of body up to 185 mm. Greatest length of skull 42·86 mm. Zygomatic width up to 23·5 mm. Alveolar length of the upper molar row up to 7·3 mm. *M. nigriculus*, Nehr., [1898.

II. Belly light-coloured. A transversal black stripe on the breast between the fore-paws. Striking contrast between the colouring of the breast and of the belly.

a. Length of body up to 170 mm. Greatest length of skull 40 mm. Zygomatic width up to 21·5 mm. Alveolar length of the upper molar row up to 7·1 mm. The stripe on the breast small and narrow, of a brownish tint............ *M. koenigi*, Satunin, [1900.

a'. Length of body up to 135 mm. Greatest length of skull 35 mm. Zygomatic width up to 20 mm. Alveolar length of the upper molar row up to 6 mm. The breast-stripe somewhat larger, clear black in colour .... *M. brandti*, Nehr., [1898.

III. Belly pure white; on the breast, between the fore-paws, a slightly marked spot of a greyish-sandy colour.

a. Back brownish grey, a wide pale greyish band across the breast and on the inside parts of the front paws. Alveolar length of upper molar row 4·4 mm. .... *M. microdon*, Ognev, [1925 *.

a'. Back pale, sandy-straw coloured. The breast-spot very small, in colour and tint like the back. Length of body up to 136 mm. Greatest length of skull 30·3 mm. Alveolar length of the upper molar row up to 5 mm. .. *M. eversmanni*, [Brandt, 1859.

The geographical distribution of these forms, excluding *Mesocricetus raddei*, which has already been discussed, is as follows in its main features :—

M. nigriculus, Nehr. Plains to the north of the Caucasus mountains, from the hill-ranges on the south to the river Kouma on the north. Does not extend to the east further than Khassav-Jurt, province of Terek. Westward it is known from the valley of the river Malka.

M. koenigi, Sat. The Transcaucasus. Plateau of Kars to Mount Ararat on the east. The boundaries between this and the next species are the Zangesur, Hangin, and Gotcha mountain ranges.

M. brandtii, Nehr. Government of Tiflis and Talish (according to Satunin it may be perhaps a distinct subspecies).

M. microdon, Ogn. So far, found in the district of Bougourouslan, government of Samara, about 53° north lat., and in the northern part of the government of Orenbourg.

M. eversmanni, Brandt. The Kirghis steppes, as far as the government of Orenbourg on the north and the province of Ouralsk on the west. It is possible that this species is found in some parts of the Russian Turkestan, and that it reaches to the right side river-banks of the Volga on the west.

Moscow University Zoological Museum,
March 1926.

* S. I. Ognev, Mammifères du gvt. de Samara et de la province de l'Oural. Bulletin de la Soc. des Naturalistes de Moscou, 1925, t. xxxii. pp. 1–47.

XIV.—*Erythrism in Monkeys of the Genus* Cercopithecus. *Studies of Variation in Mammals.* By Ernst Schwarz.

Among the many species which have been described as members of the genus *Cercopithecus*, quite a number have always been a stumbling-block to the systematic worker, as their relationships are not easily made out. A revision of the type-specimens of some of these forms, mostly in the collection of the British Museum, has shown them to be only colour-phases or extreme specimens of species described elsewhere from the normal phase.

Erythrism, albinism, and melanism occur, with a certain amount of regularity, among wild specimens of African monkeys. Cases of albinism in *Cercocebus* and *Cercopithecus* have been described by the writer*; to these two should be added now (1) a case of partial albinism in a specimen of *Cercopithecus nictitans martini* (B.M. No. 15.2.24.1), in which interspersed white hairs occur on the back, tail, and outside of limbs, along and spreading from the intersegmental lines, and (2) a case of almost total albinism in the skin of *Cercopithecus albogularis rufilatus* (B.M. No. 24.11.1.1., ♂, Morogoro, E. Africa, Zool. Soc.), which is pure white except for a rufous tinge in the anal region and the adjoining portion of the tail.

Erythrism and flavism are products of a reduction of the black pigment (eumelanine) in the skin and hairs, as a consequence of which the yellow pigment (phæomelanine) predominates or is even produced in greater quantity. Both types of pigment are produced and inherited independently from one another. Black pigment is generally developed later in life, erythrism being therefore more apparent in young than in old individuals. The following forms may be considered to be more or less erythristic specimens.

Cercopithecus stairsi, Sclater, and *C. stairsi mossambicus*, Pocock.

1892. *Cercopithecus stairsi*, Sclater, P. Z. S. p. 580, pl. xl. (Chinde, Delta of Zambezi River).

1907. [*Cercopithecus stairsi*] *mossambicus*, Pocock, P. Z. S. 1907, ii. p. 705 (Mozambique).

The type of *C. stairsi* was a young male kept alive at the Zoological Gardens, Regent's Park, and is now in the British Museum (B.M. No. 93.11.16.1, Chinde, Delta of Zambezi River). It is pale olive-green above with much pale rusty-red on the lower back, most conspicuous in the anal region and the upper side of the basal portion of the tail; this colour

* Ann. & Mag. Nat. Hist. (8) v. pp. 527–530 (1910).

is also spreading to the inner side of the thighs, and there is a line of it outside them. There is a strong suffusion of bright rusty red on the crown and two conspicuous rusty marks on each side above the ears, corresponding to the anterior portion of the parieto-occipital band found in *C. nictitans petaurista*. There is not much speckling in the whole animal, except in a very limited area between the shoulders. The lower surface is nearly white.

The type of *C. s. mossambicus*, also originally kept at Regent's Park, a much older animal, although not fully adult (B.M. No. 8.5.7.2, ♂, "Mozambique"), agrees with it as closely as possible, the differences described by Pocock being merely due to age. As a consequence, the red areas on the back and head are reduced, the ear-marks, although conspicuous enough, are less clearly defined, the arms and thighs are pale grey, and the hands and feet blackish. The lower surface is whitish as in the type of *C. stairsi*.

This last specimen agrees closely with one of the metatypes of *C. albogularis beirensis*, Pocock, which has the same pale underside, the same shade of coloration on the back and legs, including the rusty tinge on the inner side of the thighs, and the conspicuous caudal patch. It only differs in the general reduction of red on the rump and the absence of ear-marks.

C. a. beirensis itself is absolutely identical with the type of *C. erythrarchus*, Peters, in the Berlin Museum (No. 16059, ♂ juv., Inhambane, *W. Peters*). This local form of *C. albogularis* is characterized by the pale olive-green colour above, pale greyish legs, light belly, and, in its normal phase, the reduction of the red on the rump to a conspicuous patch close to and above the root of the tail. It is easily distinguished from the more northern *C. a rufilatus*, Pocock, which is much darker both above and below, and has a strong ochraceous suffusion on the greater portion of the back. On the other hand, the race of southern Mozambique approaches the dark and dull-coloured *C. a. labiatus*, I. Geoffroy, of the south-east coast, which has a particoloured tail. For the present, this race should stand as *C. a. erythrarchus*. It may later prove to be the same as *C. monoides*, Geoffroy, the type of which in the Paris Museum will shortly be examined.

Incidentally it may be noted here that the type-specimen of *C. albogularis*, Sykes, is still in the British Museum (B.M. No. 55.12.24.13, ♂). In the colour of the back, the lower surface and legs, and in the extension of the throat-band, it perfectly resembles a skin from Zanzibar Island in the British Museum and two skins from Tumbatu Island, off

Zanzibar, in the British and Berlin Museums. This leaves no doubt that the type-locality of this time-honoured species is Zanzibar Island.

Cercopithecus rufotinctus, Pocock.

1907. *Cercopithecus rufotinctus*, Pocock, P. Z. S. 1907, ii. p. 706 (? Mombasa, Kenya Colony).

The type of this form, originally an inmate of the London Zoo, was imported alive from Mombasa, Kenya Colony. It is rather a young animal and evidently a rufous phase of the local form later described as *C.* (*Insignicebus*) *albogularis zammaranoi*, de Beaux *, which it resembles in the darkish shoulders, deep mouse-grey thighs, black arms, and the upward extension of the white throat-band. Even more than the types of *stairsi* and *mossambicus* this specimen must be regarded as an erythristic one. It has the lower back, inside of thighs, and crown more or less deeply tinged with rufous of a darker shade than in the two Mozambique specimens; as in these, with the reduction of black, the lower surface has become much lighter than usual. The local form of this monkey inhabiting the "gallery forests" of the Juba River, from where specimens have been examined at the Berlin and Frankfurt Museums, will now have to stand as *C. a. rufotinctus*, with *zammaranoi* as a synonym.

Cercopithecus insignis, Elliot.

1909. *Cercopithecus insignis*, Elliot, Ann. & Mag. Nat. Hist. (8) iv. p. 274 ("Congo").

The race of *C. albogularis* inhabiting the Virunga volcanoes, north of Lake Kivu, and their immediate vicinity, *C. a. kandti*, Matschie, is a very variable one, exhibiting specimens from pale ochraceous-green to bright chestnut-red, thus normally showing a tendency towards erythrism. As has been pointed out by the writer † and by Lönnberg ‡, *C. insignis*, the type-specimen of which the writer saw alive at the Antwerp Gardens in 1910, and now has re-examined at the Congo Museum, Tervueren, is a young animal of the red phase. Elliot's name must be united as a synonym with *C. a. kandti*.

Cercopithecus inobservatus, Elliot.

1910. *Cercopithecus inobservatus*, Elliot, Ann. & Mag. Nat. Hist. (8) v. p. 81 ("W. Africa").

The type of this "species" is an old faded specimen in the British Museum (B.M. No. $\frac{47.3.1.6}{17.3.4.4}$, ♂). It presents a

* Atti Soc. Ital. Sci. Nat. lxii. p. 248 (Bidi Sciondo, L. Juba River).
† Erg. z. Deutsch. Zentr. Afr. Exp., Zool. i. p. 844 (1920).
‡ Rev. Zool. Afr. vii. p. 135 (1919).

a reduction of black, but rather more than is normal of the red pigment. This is most conspicuous in the frontal band, which is pale rusty red. Except for this trace of partial erythrism, there is nothing remarkable. *C. inobservatus* is an absolute synonym of *cephus.*

Cercopithecus insolitus, Elliot.

1909. *Cercopithecus insolitus*, Elliot, Ann. & Mag. Nat. Hist. (8) iv. p. 258 ("N. Nigeria").

This "species," based on a deteriorated young skin, is, as is "*C. inobservatus*," a specimen with partial erythrism. It differs from normal specimens of *C. nictitans martini*, of which it is a synonym, in having a strong rufous suffusion in the superciliary band and the nose-patch.

Cercopithecus erythrogaster, Gray.

1866. *Cercopithecus erythrogaster*, Gray, P. Z. S. p. 169, pl. xvi ("W. Africa").

The type of this form is a fairly young female specimen in a wretched condition, now carefully made into a skin and skull. It much resembles *C. nictitans petaurista* in the coloration of the back, in the general plan of arrangement in the cheek and parietal bands, and in the white silky beard. It differs in the crown being decidedly paler than the back, in the much broader parietal band, and in the upper portion of the cheeks not being black, but speckled like the crown of the head. Moreover, the chest and belly are rusty red ("Russet" of Ridgway), sharply set off from the white throat, and rather clearly separated from the inside of the limbs. There is no type-locality.

A second specimen, also from captivity (B.M. 15.6.12.1, ♂, Lagos, Zool. Soc.), is much like the type, but paler throughout and with a yellowish-green hue, with the crown citrine, and the parietal band even broader. The chest and belly are not red, but pale brownish grey (slightly paler than Ridgway's "Hair Brown"), quite as sharply contrasted as in the type with the pure white throat. It appears fairly certain that this specimen belongs to *erythrogaster*, the type of which is a partly erythristic specimen. A specimen in Lord Rothschild's museum, Tring, agrees almost perfectly with the grey-bellied Lagos specimen, but has a red belly like the type. As it is of about the same age as the Lagos animal, and also a male, it would appear that the red belly is a phase-character of this form.

C. nictitans erythrogaster, as this form should be called, proves to be intermediate both geographically and in coloration between *C. n. petaurista* and the dark *C. n. martini*. In its white beard it is much nearer to *petaurista*, but in the

coloration of the cheeks, lower surface, and the extension of the parietal band it shows tendencies of development in the direction of the blackened, more eastern races of the species.

XV.—*A new Black-and-white Guereza from the Ivory Coast.* By Ernst Schwarz.

In laying out the series of *Colobus* in the British Museum a new local race has been found connecting the Gold Coast and Liberia–Sierra Leone forms hitherto regarded as separate species.

Colobus polykomos dollmani, subsp. n.

Intermediate between *C. p. polykomos* and *C. p. vellerosus*.

Superciliary band broader and longer-haired than in *vellerosus*, not quite sharply defined behind, but not broadly extending on to the top of the head. Whiskers long, shiny, as is also the white throat-fringe, both of which are much as in *vellerosus*, but consist of longer sparser hairs, similar to but not so sparse as in *polykomos*. Shoulder-mane scarcely mixed with whitish hairs, as is also the inner side of the upper arms, but not the chest, which is deep black as in *vellerosus*. There is a sharply-defined white area round the anal callosities, but no white patch on the thighs. Tail white with a thin but distinct brush at the tip.

Type-locality. Bandama, Bandama River, Ivory Coast.

Type, B.M. 23.2.3 4. Fairly old male. Collected by Messrs. W. P. Lowe and H. R. Hardy on December 31, 1922.

Specimens examined. Two, both from the type-locality.

Measurements of Type :—Head and body 675 mm., tail 938, hind foot 168, ear 37.

Skull. Basal length 91·6 mm., greatest length 117·0, palatal length 48·7, occipital width 67·4, zygomatic width ca. 78, intertemporal constriction 42·0, length of upper tooth-row (including canine) 42·4.

This striking new form bridges the gap between the two well-known Upper Guinea races of black-and-white Guereza. On the whole, it has the markings of the Gold Coast *C. p. vellerosus*, but in the structure of the hairs of the whiskers and throat-fringe, in the beginning of an upward extension of the superciliary band and of a grey admixture in the shoulder-mane, and in the absence of a thigh-patch it approaches *C. p. polykomos*, which is the local race of Liberia and Sierra Leone.

It gives me much pleasure to connect with this form the name of Captain J. G. Dollman of the Mammal Department of the British Museum.

XVI.—*A remarkable new Monkey from Peru.* By OLDFIELD THOMAS.

WHEN Mr. R. W. Hendee, working on the Godman-Thomas Expedition to Peru, sent home the collection of mammals described in No. III. of the series of papers on his collection * he omitted, for reasons of transport, to forward three monkeys he obtained at Puca Tambo, in North Peru, the other mammals from the same locality being included in the paper.

These specimens have now arrived, and prove to represent a very remarkable new monkey, allied to *Lagothrix*, but so very unlike any known member of that genus that I consider it should form a special subgenus.

Lagothrix (*Oreonax*, subgen. n.) *hendeei*, sp. n.

Size about as in average species of *Lagothrix*. Fur thick and soft, its texture more normal than in *Lagothrix*. General colour of head and fore-body deep black with a subdued coppery tinge, which gradually increases backwards until on the hinder back it becomes a deep rich vinaceous russet or rufous chestnut, which colour is continued down the tail to the end. Under surface dull black. Face blackish, fairly well covered with hair, its middle portion from below the eyes to the point of the chin clothed with white hairs, as in certain Old-World monkeys, but not in *Lagothrix*. Arms and legs black throughout; hands and feet very thickly clothed with fur to the ends of the digits, these members being more buried in the fur than in any members of true *Lagothrix*. Hairs on scrotum long and thick, forming a prominent tuft over 4 inches in length, deep rich yellow; a much smaller tuft of yellow hairs in the same region of the female. Under surface of middle portion of tail deep buffy, this colour extending along each side of the naked part, as an edging to the general deep red of the upper surface.

Young coloured like the adult, but the yellow on the pudenda and under surface of the tail not yet developed.

Skull essentially as in the species of *Lagothrix*, but the nasals are not so definitely concave and retroussé, and the incisors are distinctly more prognathous.

Dimensions of the type :—

Head and body 520 mm.; tail 560; hind foot 145; ear 32·5.

Skull: greatest length 106; condylo-basal length 89; maxillary tooth-row 27·5.

* Ann. & Mag. Nat. Hist. (9) xviii. p. 156 (1926).

Hab. Puca Tambo, about 50 miles east of Chachapoyas, N. Peru, 5100′.

Type. Adult male. B.M. no. 27. 1. 1. 1. Collected 27th January, 1926. Three specimens—male, female, and young.

Considering its size, striking coloration, and entire distinctness from any species known, this monkey forms one of the most remarkable discoveries that has taken place for a long time. Mr. Hendee has taken such extreme and intelligent interest in his work that he well deserves to have his name connected with so interesting a capture.

While all the previously known members of *Lagothrix* are exceedingly uniform, this one stands widely apart by its coloration, short woolly limbs, and other characters, and I think should bear a special subgeneric name.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 23rd, 1926.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

Prof. Henry Fairfield Osborn, For.Memb.G.S., delivered a lecture on the Methods and Results of the American Museum Expedition in the Gobi Desert, 1922-1925.

He said that a new volume in the life-history of the Earth, composed up to the present of 24 chapters, had been revealed by the discoveries of the Mongolian Expeditions of the American Museum of Natural History, under the leadership of Roy Chapman Andrews. Central Asia, and especially the region east and south-east of Chinese Turkestan, has long remained the *terra incognita* of geology, palæontology, and, in a minor sense, of geography. In 1900 the lecturer predicted that the unknown high-plateau region of Central Asia, rather than the well-known Asiatic provinces on the south, such as the Siwalik Hills of India explored by Hugh Falconer (1830-1850), would prove to be the chief centre of the origin and distribution of the mammalia, from which waves of north mammalian life radiated to the continents of Europe and of North America.

Andrews's expeditions in the three seasons of 1922, 1923, and 1925 have not only completely verified this prediction, but have also revealed the high Central Asiatic plateau-region as the chief home of the terrestrial deinosaurian reptiles of Upper Jurassic

STONE AGE, TERTIARY, AND CRETACEOUS FORMATIONS OF MONGOLIA, IN DESCENDING ORDER.

Regions.	*Formations and thickness estimated in feet.*		*Probable or estimated Geological Age.*	*Human Culture, Mammalian and Reptilian Life-zones.*
Altai Piedmont	SHABARAKH USU	50+	Upper Palæolithic	? Azilian-Campignian.
Do. do.	OROK NOR	5–40	Middle Palæolithic	? Aurignacian-Mousterian.
			Lower Palæolithic	? Acheulean or ? Eolithic.
Orok Nor basin	KHUNUK	27–120	Lower Pleistocene	? *Equus*, ? *Mastodon*.
Tsagan Nor basin	TSAGAN NURU	50±	Lower Pleistocene	? *Equus*, ? *Struthiolithus*.
	GOCHU	1000±		
Eastern Altai Mts.	HUNG KUREH	1000	Upper Pliocene to Lower Pleistocene	*Hipparion*. *Camelus* zone.
Iren Dabasu basin	PANG KIANG	500	Miocene; age doubtful	Rodents. ? *Ochotona*.
Eastern Altai Mts.	LOH	100–1000	Middle Miocene	*Mastodon* (*Serridentinus*) zone.
Do. do. do.	HSANDA GOL	3000	Middle to Upper Oligocene	*Baluchitherium grangeri* zone.
Iren Dabasu basin	HOULDJIN	30–50	Do. to Do. do.	Do. do. do.
Orok Nor basin	ELEGEN	0–200	Do. to Do. do.	? Mammals undetermined.
Uliassutai Trail	BARON SOG	5–30	Middle Oligocene	? Large Titanotheres.
Do. do.	ULAN GOCHU	2–60	Lower Oligocene	? Do. do.
Uliassutai Trail	ARDYN OBO	500	Do. do.	*Brontops gobiensis* zone.
Do. do.	SHARA MURUN	200±	Summit of Eocene	*Protitanotherium mongoliense* zone. *Amynodon mongoliensis*.
Shara Murun basin	TUKHUM	50+	Upper Eocene	Titanotheres abundant.
Iren Dabasu basin	IRDIN MANHA	? 100	Do. do.	*Eudeinoceras*, *Andrewsarchus* zone.
Do. do. do.	ARSHANTO	40–100	? Middle Eocene	Lophiodonts-*Schlosseria* zone.
Kholobolchi Nor basin	KHOLOBOLCHI	1000±	? Lower Eocene	*Coryphodon* zone.
Eastern Altai Mts.	GASHATO	300	Basal Eocene (Paleocene)	*Prodeinoceras* zone. *Palæostylops*.
Eastern Altai Mts.	DJADOKHTA	500	Middle Cretaceous	*Protoceratops andrewsi* zone.
N.E. of Shabarakh Usu	DOHOIN USU	200±		*Deinosauria*, *Crocodilia*, *Chelonia* zone.
Iren Dabasu basin	IREN DABASU	180	Lower Cretaceous. ? Wealden	Iguanodont. Ornithomimidæ.
Oshih basin	ASHILE	2000	Upper Jurassic	*Psittacosaurus* zone. *Asiatosaurus*. *Prodeinodon*.
Tsagan Nor basin	ONDAI SAIR	500	Do. do.	*Protiguanodon* zone.

and of Cretaceous time. In brief, these discoveries establish Mongolia as a chief centre of northern terrestrial life-history, from the close of Jurassic time onwards to the very close of Pleistocene time.

From the standpoint of palæogeography the outstanding geological discoveries of the expedition are:--

First, that this Central Asiatic continent of Gobia, as it has been named by Grabau, was for several millions of years extremely favourable to the evolution of reptiles, mammals, insects, and plants, and probably birds as well, hitherto known along the low-lying Cretaceous forelands of Western Europe (such as the Wealden of England and Belgium), and in less degree of Southern Asia. Secondly, that this now terribly desert region of Gobia, traversed only by the gazelle and the wild ass, and thoroughly uninhabitable in the summer season, was abounding in life throughout Upper Jurassic, and throughout all Cretaceous and Tertiary time, sparsely forested, traversed by streams and rivers, with a limited seasonal rain-supply like the high-plateau region of Central Africa to-day. Thirdly, these dry and stimulating upland conditions of Tertiary time, as compared with the densely forested conditions of the Asiatic lowlands, have led to the recent prediction by the lecturer on returning from Iren Dabasu in 1923, that this region is the most likely one in which to search for the Tertiary ancestors of man, namely, those of Eolithic or Dawn-stone Age, though no traces of man have, as yet, been discovered by the expedition older than those of Lower Palæolithic age. The discovery of human and pre-human remains in Tertiary time has thus become one of the chief remaining objects of the expedition.

During the season of 1925 a great culture-camp, probably of Azilian-Campignian time, was discovered on the eastern slopes of the Altai Range, not far from Shabarakh, and not far from Djadokhta, where the now famous deinosaur eggs were discovered, far north of the Ordos locality explored by Licent and Teilhard de Chardin. In fact, these Upper Palæolithic artisans collected the broken shells of the deinosaur eggs with which to manufacture necklace ornaments, these perforated fossil shells serving as well as the recent eggshells of the giant *Struthiolithus*, the great ostrich of the Stone Age of Mongolia. No human fossils have so far been found: the industrial levels are not as yet precisely determinable, but the chief anthropological fact is established that the Stone Age tribes spread over the borders of the Gobi Desert region during the Ice Age, establishing their quarries near the large lakes bordering the Altai Mountains on the east and fed by glacial streams. The geologists of the party have discovered traces of this glacial age along the summits of the Altai Range.

As for methods, by combining a very large caravan for the camel transport, which leaves Kalgan on the 1st of December, and reaches the eastern base of the Altai Range on the 1st of May, with an automobile train of five to seven cars, the expedition had the great advantage of speed over the previous geological explorers

who crossed the Desert with camels only. The geologists and palæontologists of the party, Granger, Berkey, and Morris, with two field assistants, also had the advantage of prolonged experience in the field formations of the Western United States, which, between the 50th and 40th parallels of latitude, present conditions remarkably similar to those found in the Desert of Gobi. Raphael Pumpelly in 1864, Ferdinand von Richthofen in 1872, and V. A. Obruchev in 1909 found no fossils, except the single rhinoceros-tooth brought back by Obruchev; and other geologists traversing this region have thought that there were no fossils to be found.

As to geology, the expeditions beginning on April 15th, 1922, 260 miles north-west of Kalgan, and encircling in 1922, 1923, and 1925 the entire Gobi district in a 3000-mile radius, discovered no fewer than 23 distinct geological formations extending downwards from Lower Pleistocene time into Lower Cretaceous and Upper Jurassic. These have a thickness varying from 50 to 3000 feet, and were deposited in the great flood-plains of ancient rivers, or in broad river-valleys, or at the base of ancient mountain-chains, or in the torrents of great sandstorms such as the Djadokhta, testifying to the secular vicissitudes of climate, mostly of rainfall, terminating with the pluvial period of the Ice Age, followed by a long period of secular desiccation.

Some of these formations prove to be closely contemporaneous with the Lower Cretaceous Wealden of Western Europe, owing to the presence of large Iguanodonts, equalling the famous *I. bernissartiensis* of Belgium in size. The oldest are as early as the Oxfordian and Purbeck of Upper Jurassic times. The climax of reptilian life is reached in the marvellous sand-swept deinosaur breeding-grounds of Middle Cretaceous time, where nests of fossil eggs and innumerable skulls and skeletons of *Protoceratops* are found in almost perfect preservation. This is the richest deinosaur deposit thus far discovered in Eurasia.

As to the 15 succeeding Tertiary formations, they compose so many unbroken chapters of the history of Mongolian life as extend from the basal Eocene Gashato to Upper Oligocene time, where the giant *Baluchitherium* occurs, as discovered also in Baluchistan by Cooper of Cambridge, and in Chinese Turkestan by Borissiak of Moscow. The Miocene and the Pliocene Periods are represented by four formations.

Thus the scientific staff of the Expedition, between the years 1922 and 1925, has interpreted one of the most typically desert regions of the entire world by means of the twin sciences of palæontology and geology, and the wilderness of Mongolia now blossoms forth, with its glorious story of prehistoric life, as the homeland of the greater number of known upland terrestrial vertebrates.

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XVII.—*Fossil Insects from the Miocene of Colorado.* By T. D. A. Cockerell, University of Colorado.

The insects described in the present paper were all collected by Mr. Geo. Sternberg in the Miocene shales of Florissant, Colorado, and are the property of the British Museum.

Diptera.

Rhabdomastix (*Sacandaga*) *præcursor*, sp. n. (Tipulidæ).

♂.—Expanse 13 mm.; wings 6 mm. long, clear hyaline, with brown veins; length about 6·7 mm.; antennæ about 2 mm.

Thorax produced and narrow anteriorly; abdomen with six broad brown rings, about as wide as the intervals between them, but the interval between first and second less (abdomen is marked as in *R. labefacta*, Scudd.); venation similar to that of the living *R. flava*, Alex., except as follows: subcosta ending a little earlier, at about beginning of last third of præfurca (it is almost the same in Alexander's original figure (1911), and probably his later figure (1919) is not quite correct); first radius ending about 320 μ before end of *R* 2, the latter about as long as this interval, and striking costa at an angle of about 45°. In my first study of the fossil I thought

I saw a radial cross-vein, but later, with better light, failed to make it out; this vein is evanescent or absent in the living species. Discal cell longer, with broader base, its face on second basal about two-thirds as long as its face on first basal; second posterior cell (between branches of media) very narrow on discal, about or hardly a fifth of third posterior on discal. Third posterior cell long and not far from parallel-sided (style of *R. caudata*, Lundb.). The second anal has a strong double curve as in *R. flava*. Legs, as far as visible, dark brown.

This fossil is of exceptional interest, as Alexander (1919) says of *Rhabdomastix*: "The group is close to *Gonomyia*, but the male hypopygium has a very different structure, and is of a distinctly primitive type." The genus, with few species, occurs in Australia, New Zealand, and North and South America, and in 1923 I discovered a new species on the eastern coast of Siberia.

A review of the fossils ascribed to *Gonomyia* brings out the fact that four of them are evidently *Rhabdomastix* *. The following key separates the fossil species of *Rhabdomastix* found in North America:—

	Second posterior cell with base extremely narrow	*præcursor*, Ckll.
	Second posterior cell with base broad	1.
1.	Præfurca strongly arcuate at base (Florissant Miocene)	*frigida* (Scudd.).
	Præfurca not thus arcuate	2.
2.	Wing over 8 mm. long (Florissant Miocene).	*labefacta* (Scudd.).
	Wing 7·5 mm. or less	3.
3.	Discal cell not nearly so long as second posterior (Florissant Miocene)	*primogenitalis* (Scudd.).
	Discal cell about as long as second posterior (Roan Mt., Colo., Eocene)	*scudderi* (Ckll.).

The Isle of Wight Oligocene *Gonomyia* do not belong here. Perhaps *Gonomyia* originated in the Eurasian area, and *Rhabdomastix* in America or the Southern Hemisphere. The latter must be considered the more primitive.

Tipula rigens, Scudder.

A good specimen, with reverse.

Limnocema sternbergi, sp. n. (Tipulidæ).

Length 9·5 mm.; body dark brown, the sutures of the abdomen marked by narrow hyaline bands; femora 6 mm.

* Dr. C. P. Alexander informs me that he is of the same opinion. He tells me that there are two living species of *Sacandaga* in Europe.

long, brown; wings 8 mm. long, hyaline, with pale bristly veins, no stigmatic spot; beginning of præfurca 3·4 mm. from base of wing.

Subcosta ending at level of end of præfurca; no radial cross-vein (I thought I could see it in the usual place with the binocular, but on using a higher power it disappeared); a cross-vein at right angles, going to margin, near end of *R* 2+3, and 590 microns beyond end of *R* 1 (this is delicate, but positively visible with high power; I assume that it can only represent the divergent end of *R* 2); discal cell long, its base 240 microns basad of base of fourth posterior, its apex the same distance beyond basal end of second posterior; second posterior on upper side 2320 microns long; third posterior on margin 590, and fourth on margin 1010 microns; præfurca 1185 microns long, very strongly arched at base; base of fourth posterior cell 370 microns.

If this belongs to Scudder's extinct genus *Limnocema*, as it seems to do, then we must assume that the "marginal cross-vein near the extreme apex of wing" is really the end of *R* 2, and the genus has in reality two submarginal cells. But in Scudder's species the vein referred to runs into *R* 1, and not into the costa beyond its tip. In the living *Dicranota rivularis*, O.-S., the marginal cross-vein is present as usual, but also an apparent cross-vein, evidently *R* 2, placed as in Scudder's species of *Limnocema*, running into the apical part of *R* 1. The first basal cell being a little shorter than the second agrees with *Limnocema* rather than *Limonia*, in which genus I first thought the fly might fall. The anal angle of the wing is quite pronounced, about as in *Rhipidia bryanti*, Johnson.

Rueppellia vagabunda, sp. n. (Therevidæ).

Length 5 6 mm.

Head and thorax dark brown, abdomen paler, the sutures rather broadly hyaline; the abdomen is of the usual form (not slender and subclavate as in *Henicomyia*); antennæ not preserved; a hind leg shows femur and tarsus dark brown, tibia somewhat paler; the hind tibia is very long (1440 microns), much longer than the femur. Wing 3·6 mm. long, ample, hyaline, faintly reddish, with brown stigmatic area; veins pale. The body is not appreciably pilose, but essentially bare as in some modern forms. The venation agrees in all important respects with that of *Rueppellia semiflava*, Wied. (Verrall, 'British Flies,' Stratiomyidæ, &c., p. 543), but differs thus: radial vein straight, bent only at

its extreme tip, where it ends on costa about or slightly before midway between base and apex of second submarginal cell; discal cell long and narrow, the cross-vein above it 320 microns from the base and 530 from apex; second submarginal cell (cubital fork) not directed downward so much, its lower side reaching the wing-tip; fourth posterior cell extending beyond discal a distance greater than apical width of discal. The second submarginal has its base very slightly beyond level of end of discal.

The generic characters in the venation are the long (1170 microns) and parallel-sided cubital fork, its base rounded and obtuse (more so in the fossil than the recent species, and the course of the cubital vein in the fossil in a line with its lower branch); discal cell long, the anterior cross-vein before its middle; five posterior cells, the fourth closed some distance before margin; anal cell closed near margin.

The reference of this species to *Rueppellia*, based on a species found in Egypt, may not be valid, but I am at a loss to name any distinguishing generic characters. In the genus *Psilocephala* the venational differences easily parallel those between the living and fossil *Rueppellia*. Thus, as regards the radial vein, the living species resembles *P. tergissa*, Say, the fossil *P. festina*, Coq.

Bibio wickhami, Cockerell.

A good specimen, with wing 8 mm. long (6·75 mm. in type). The larger size does not indicate a different species; the living *B. albipennis*, Say, varies in wing-length from 5 to 9·5 mm.

HYMENOPTERA.

Euponera hendersoni (Cockerell).

In 1906 I described *Ponera hendersoni* from a specimen collected at Florissant. I left the type in the office of the Department of Biology, but it mysteriously disappeared. It is very satisfactory to find three specimens in the Sternberg collection. The species goes better in *Euponera* than *Ponera*; it differs in venation from *E. succinea* (Mayr), from Baltic amber, by having the second intercubitus practically in a straight line with the first section of the radius (below the stigma), this feature and the long marginal cell agreeing with *Diacamma*. The second cubital cell is longer than in *E. succinea*, and the nervulus is more remote from the discoidal, the distance being a little greater than

its length. The last character agrees with *Agræcomyrmex*, from Baltic amber. The middle tibiæ and basitarsi are without bristles, so the species does not belong (as does *E. succinea*) to the subgenus *Trachymesopus*. The wings are brownish.

Tetramorium peritulum, sp. n. (Myrmicidæ).

♂.—Length 4·3 mm.

Of the usual form, but head rather large; dark brown, the abdomen paler; anterior wings 4 mm. long, hyaline, with pale reddish veins; stigma pale. Venation as in *P. cæspitum*, L., but the discoidal cell somewhat smaller, and upper part of basal nervure less oblique, less nearly in a line with the lower part. The following measurements are in microns: length of marginal cell, 1600; length of cubital cell, 960; discoidal cell on first cubital 130, but its lower side 320; end of cubital cell to radio-cubital fork, 160.

I had to consider the possibility that this might belong to Donisthorpe's genus *Leucotaphus*, but though the structures at the base of the abdomen are not very clear, they seem to me to be as in *Tetramorium*. Donisthorpe rightly criticises my reference of the type-species of *Leucotaphus* (*L. gurnetensis*, Ckll.) to *Leptothorax*, but I had only the wings *.

Formica impacta, sp. n. (Formicidæ).

♀.—Length nearly 17 mm., anterior wing about 11 mm.

Robust, dark brown, the abdominal sutures broadly hyaline; head rather regularly oval, not broadened behind; mandibles massive, minutely denticulate; lower margin of clypeus entire, gently arched; wings hyaline, with dark brown stigma and brown veins. Venation essentially as in *F. rufa*, L., but radio-cubital fork rather wider, first part of radius much less oblique, cubital cell therefore much less produced apically; upper part of basal nervure more oblique, almost in line with lower part, which is not much longer than upper; discal cell less broadened basally; nervulus more oblique, and rather more remote from discal cell. The broader angle at end of cubital cell is the best character; Heer's Oeningen fossil *Formica* species are like the modern ones in this particular. This character, it must be said, indicates resemblance to *Lasius*, but so large an ant can hardly belong to that genus.

* I now think that my variety *a* (Proc. U.S. Nat. Mus. vol. xlix. pl. 65. f. 5) of *Leucotaphus gurnetensis* is to be separated; it is really more like *Lasius* in some respects. It may be called *L. permancus*.

Braconidæ.

Microdus miocenicus, sp. n.

♀.—Length (not counting ovipositor) 5·2 mm.; abdomen 3 mm.; ovipositor 2·5 mm.; anterior wings about 3 mm.

Antennæ of moderate length, black, joints with delicate raised lines (I find the same in *Bracon exoratus*, Cresson, which I collected at Boulder, Colorado); head, thorax, and abdomen ferruginous; head short, not rostrate; thoracic dorsum darkened. Wings hyaline, with dark brown stigma. Abdomen claviform. Hind femora dark; hind tibiæ pale, the apical part abruptly black, their tarsi dark. Stigma large; marginal cell narrow, with the characteristic form of the subfamily; second cubital cell indistinct, but subtriangular and very broad; the basal nervure cannot be seen. At first sight there is apparently a large costal cell, but this is due to the costal margins of the two wings, one a little above the other. The broad second cubital and short head indicate *Microdus*. The genus *Earinus* is similar, but has a longer marginal cell, at least in *E. thoracicus* (Nees). According to Viereck, *Microdus* is to be called *Bassus*, following a type-designation by Curtis, but *Bassus* is generally used for a totally different insect.

Miocene of Florissant (*Sternberg*, 176 B).

This is the first fossil *Microdus*.

XVIII.—*Some Observations and Experiments on the Spine-Formulæ of* Cyclops. By A. G. Lowndes, M.A., F.L.S., Marlborough College.

DEFINITIONS.

By the term *spine-formula* is here meant the number of spines on the outer edge of the terminal joint of the outer ramus of the four pairs of swimming-feet taken in their respective order.

By a *spine* is meant a short and relatively stout process whose edges bear very definite denticulations along the whole or along a part of their length. The definition is necessary at this juncture in order that a distinction may be made between a spine and a seta. Setæ are processes that are relatively thin and pliable, and which bear fine hairs or cilia in the place of the denticulations of the spines.

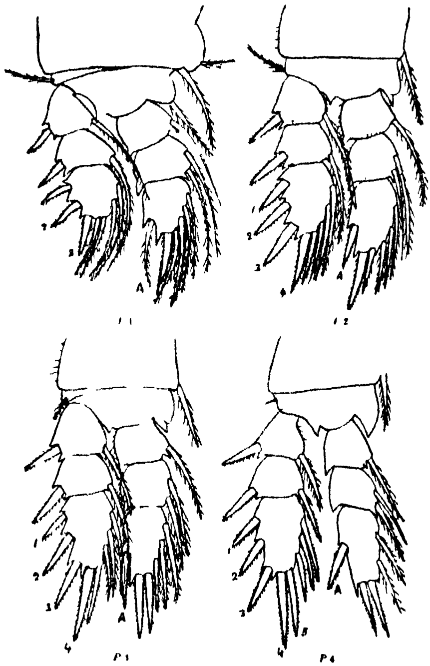
A glance at the diagram will make this plain.

The diagram represents the four swimming-feet of *Cyclops robustus*, G. O. Sars, where P 1 represents the first swimming-foot and P 2 the second swimming-foot, etc.

It will be seen that P 1 bears on the outer edge of the outer ramus of the terminal joint 3 very definite spines which are numbered 1, 2, 3, while P 2 and all the other feet bear four spines along the corresponding edges, and hence the spine-formulæ for *C. robustus* is 3 . 4 . 4 . 4.

It will be seen that along the inner edge of the same joints there are a number of *setæ*, and it should be pointed out that when there are two terminal processes as on P 4 represented by 4 and 5, the outer is considered as belonging to the outer edge, while the inner belongs to the inner edge.

Cyclops robustus G. O. Sars



The definition given here is a purely arbitrary one, and is given as being the most convenient. It represents, of course, only an abbreviated formula.

The Importance of the Spine-Formula.

Nearly all systematists have in the past paid considerable attention to spine-formulæ of some kind. Thus Sars (1) always gives the most careful attention both to the spines and setæ of the swimming-feet. In addition, he attaches considerable importance to terminal spines on the end joint of the inner ramus of P 4 and also the

nature of the process on the outer edge of the same joint (denoted in the diagram by A). It will be seen that in *C. robustus* this process is a seta in P 1, but a very definite spine on the other feet. Herrick (2) always gives the full number of spines and setæ on the end joint of both rami of the swimming-feet. Kiefer (3) pays considerable attention to the terminal spines or setæ on the end joint of the inner ramus of P 4, and considers the proportions of these processes both to each other and to the length of the joint itself as being of the utmost importance.

Some past Observations on Irregularity of Spine-Formulæ.

A great many systematists and others have called attention to variations in spine-formulæ, thus Sars (4) points out that the number of spines on the swimming-feet of *C. lucidulus*, Koch, vary:—"The terminal joint of the outer ramus having in some cases three spines outside in one or other of the pairs instead of the usual number (2)."

Chambers (5) states that:—" *C. americanus* and *C. parcus* breed true for generations. Slight variations in the number of spines of the swimming-feet among individuals of the same culture occasionally occur."

Chambers also states in the same paper that *Cyclops brevispinosus* frequently becomes sexually mature before the swimming-feet attain the number of spines characteristic for that variety.

It should be noted that *C. parcus*, Herrick, is, according to Sars (4), synonymous with *Cyclops lucidulus*, Koch, and *C. brevispinosus*, Herrick, is, according to Lilljeborg (6), synonymous with *C. robustus*. It will also be noticed that Chambers does not give any details of the conditions under which the animals were bred, nor does he state definitely that breeding-experiments were carried out.

Dwight Marsh (7), in a paper of considerable importance, discusses the value of a spine-formula for specific purposes, and very definitely states that "It is a characteristic to be reckoned with in any specific description." He also states that "I have even found an individual with the right foot differing from the left."

Description of Experiments.

During the last two years, definite breeding-experiments have been carried out with four species of *Cyclops*, with the idea of investigating the value of a spine-formula as a specific characteristic.

The four species investigated were:—

Cyclops americanus (Herrick).
Pachycyclops signatus (Koch). Syn. *Cyclops signatus* (Koch).
Pachycyclops annulicornis (Koch). Syn. *Cyclops annulicornis* (Koch).
Cyclops lacunæ (Lowndes).

Cyclops americanus was the first species to be investigated, and this will therefore be described first.

Cyclops americanus.

This species was first recorded in Europe at Coate Reservoir, near Swindon, in October 1925 (8).

The actual specimen found had the spine-formula 3 . 4 . 4 . 4. I was uncertain of the correct diagnosis of the individual in question, which was, therefore, isolated till the eggs hatched out when the adult was sent to Prof. Sars. The young nauplii were kept and placed in a bottle with about ½ litre of tap-water and fed. The method of feeding was as follows:—Some ordinary elm leaves were left to rot in a jar of tap-water. Soon an abundant supply of ciliophora was obtained. Quantities of these were drawn off, and the liquid containing them was filtered through glass wool. The food was examined microscopically before being given to the *Cyclops* in order to make certain that no foreign *Cyclops* larvæ were introduced. The experiments were carried out at laboratory temperatures, and air was blown through the jar every day and fresh food added.

After two months an abundant supply of adult females was obtained, and these were examined for spine-formulæ. It was found that whereas the spine-formula for the original female was 3 . 4 . 4 . 4, that for many of the offspring was 2 . 3 . 3 . 3.

After keeping the culture for four months it was found that in one and the same jar there were to be found adult males and females with S.F. 2 . 3 . 3 . 3, and also adult males and females with S.F. 3 . 4 . 4 . 4.

Another adult female was taken from Coate Reservoir with S.F. 3 . 4 . 4 . 4. This was bred in exactly the same way, except that the temperature was kept constant by placing the culture in an incubator at 20° C. In this case it was found that the nauplii appeared as adult females after 24 days. The spine-formula was examined for all the adults procured, and it was found to be 3 . 4 . 4 . 4 in all individuals.

Still another adult female was taken from Coate Reservoir and treated in exactly the same way. The spine-formula of the adult female was 2 . 3 . 3 . 3, and the nauplii obtained from her developed into females each of which retained the S.F. of the parent—namely, 2 . 3 . 3 . 3.

From these experiments it must be concluded that the species occurs with two distinct spine-formulæ—namely, 2 . 3 . 3 . 3 or 3 . 4 . 4 . 4.

At this stage it was not considered advisable to attempt a cross between the two varieties with the idea of obtaining a Mendelian count, since the breeding-difficulties are so great that it is almost impossible to prevent a 50 per cent. mortality among the immature individuals. Both varieties are, however, interbreedable. Two further points are of importance: (1) No individuals were

obtained with a spine-formula that could be considered a mixture, thus the formula was either 2 . 3 . 3 . 3 or 3 . 4 . 4 . 4, no such combination as 2 . 4 . 4 . 4 or 3 . 3 . 3 . 3 occurred, or even such a formula as $\frac{2.3.3.3}{3.4.4.4}$, where the upper figure represents the outer ramus on one side and the lower figure represents the outer ramus on the other side of the same pair of feet. It will be seen in the next species to be described that this is quite a common occurrence. (2) The spine-formula can be determined at quite an early period, considerably before either the genital segment has been formed with the genital organ or the anterior antennæ have acquired the correct number of joints. In other words, sexually mature individuals with undeveloped spine-formulæ *do not occur*.

Cyclops lacunæ.

This species was first found at Great Bedwyn, Wilts, in March 1926. The specimen first examined had the spine-formula 2 . 3 . 3 . 3, and it therefore differed from *Cyclops strenuus*, which has the spine-formula 3 . 4 . 3 . 3.

At the time it was considered that the spine-formula was sufficient reason for separating the newly found individual from *C. strenuus*, so the adult female was kept till the eggs had hatched out, and it was then sent over to Prof. Sars.

In addition to the spine-formula of the type in question, there were so many points in which it differed from *C. strenuus* that it was decided on the advice of Prof. Sars to give it specific rank. A preliminary description of the new species has already appeared in a previous number of this Journal (9). The nauplii were again carefully reared, and when the adults were examined it was found again that many of them did not possess the spine-formulæ of the parent.

A series of breeding-experiments was then carried out.

The method employed was as follows:—

Food.—This consisted of protozoa and also soaked leaves. Elm-leaves etc. were taken from the bottom of a pond and thoroughly washed in tap-water. Each leaf was then passed through boiling water to ensure that any adhering animals were killed, and so the possibility of introducing other crustacean larvæ was prevented.

The leaves were then allowed to rot in covered vessels and a small quantity of a culture of infusoria added. The infusoria were carefully examined, and so it can be confidently assumed that no larvæ belonging to other species of *Cyclops* were introduced.

Method.—Adult females were caught and separated. The larvæ were separated from the adult females directly they were hatched, and they were put in bottles containing about ¼ litre of Marlborough tap-water, which has a pH 7·4. The bottles with the nauplii were each provided with a glass tube for blowing air through the culture, and they were then placed in an incubator kept at 20° C. A small piece of soaked leaf was also added.

These cultures were examined every other day and fresh infusoria

added. Air was also blown through the culture for a few minutes. In this way the culture was kept apparently healthy, but it was impossible to keep down the pH value. It was found that it had almost invariably changed during three weeks from 7·4 to 8·6. After a period of 20 days it was found that adult females made their appearance, and when this happened the whole culture was examined microscopically for spine-formula.

It was always found that there were a number of females that had not yet reached maturity. The genital segment was not sufficiently developed to possess a seminal receptacle, and it could therefore be assumed that the females were in the virgin state. Certain of these were isolated, and a male was placed with each. These were then fed and put back in the incubator.

If the cross was successful as shown by the female developing egg-sacs she was isolated, and the larvæ were isolated directly they were born and reared up in exactly the same way till the adult females appeared. The whole culture was then killed and a complete analysis of the spine-formulæ was made.

In this way it will be seen that it was possible to get a cross between parents whose spine-formula was already known, and it was possible to attempt a count in order to see if some simple Mendelian ratio could be obtained.

It is not considered necessary to give the results of all these crosses.

Description of Three of the Crosses.

On May 8th the eggs hatched from an adult female taken the day before from an outside pond. Spine-formula of adult female was 3 . 4 . 3 . 3.

The nauplii were separated and reared and re-examined on May 27th. The culture was a successful one, 40 individuals being alive. Among these individuals were found adults with the following formulæ:—

Adult females	S.F. 2 . 4 . 3 . 3
	2 . 3 . 3 . 3
	2 . 4 . 3 . 3
	$2 . 3 . 3 . \bar{3}$

It will be noticed that among the females 2 is the constant for P 1.

Adult males	S.F. 2 . 3 . 3 . 3
	$\bar{2} . 4 . 3 . 3$
	3 . 4 . 3 . 3
	$\bar{2} . \bar{4} . 3 . 3$
	2 . 4 . 3 . 3
	2 . 3 . 3 . 3

These figures, of course, show very little, since nothing is known of the spine-formula of the male, and it is more than likely that the ova in the female were fertilized by the sperms from more than

one male, since one copulation will suffice for the production of several broods from the one female, and I have frequently observed copulation taking place at a time when the female is still carrying egg-sacs and the seminal receptacle is by no means empty.

From the above culture four immature females were taken and four males, and crosses made.

The spine-formulæ of the parents were taken after the eggs had hatched out. Of the crosses *the following only* need be given :—

No. 1. The first cross from the above was made on June 3rd:

S.F. for male	2.3.3.3
S.F. for female	2.4.3.3

The adults were examined on June 26th, pH of culture 8·2. Result of cross:

	Number	S.F.
Females	4	2.4.3.3
	3	2.3.3.3
	2	3.4.3.3
	4	Mixtures all with $\frac{2}{2}$ for P 1, but with $\frac{4}{3}$ for P 2. P 3 and P 4 were constant throughout.
Males	3	2.3.3 3
	2	Mixtures $\left(\frac{3.4.3.3}{3.3\ 3.3}\quad\frac{2.4.3.3}{2.3\ 3.3}\right)$

It will be noticed that the number of individuals to reach maturity is far too small to be considered satisfactory.

No. 2. The next cross to be considered was one in which the parents were taken from the same original culture as the previous one, but the spine-formulæ were different.

The result is given in the following table:

S.F. for original female	3.4.3.3
S.F. for male	2.4.3.3
S.F. for female	2.4.3.3

The cross was made on June 3rd and the culture examined on June 29th.

	Number.	S.F.	
Females	2	3.4.3.3	
	1	2.3.3.3	
	2	Mixtures	$\frac{3.3.3.3}{3.4.3.3}$ and $\frac{3.3.3.3}{2.4.3.3}$
Males	4	2.4.3.3	
	1	3.4.3.3	
	1	3.3.3.3	
	1	2.3.3.3	
	4	Mixtures	$\frac{3.4.3.3}{2.3\ [illegible]\ 3}$
	2		$\frac{3.4\ [illegible]\ 3}{2.4.3.3}$

Number.		S.F.
1	Mixtures	$\frac{3.3.3.3}{3.4.3.3}$
1		$\frac{2.3.3.3}{3.3.3.3}$
2		$\frac{2.3.3.3}{2.4.3.3}$

It will be seen that in this culture there were 22 adults examined. The number of males was greatly in excess of that of the females.

Taking the spines on one foot separately:

For P 1 . .	6 with 3 spines.	
	8 ,, 2 ,,	
	8 ,, mixtures.	
For P 2 . .	9 with 4 spines.	
	3 ,, 3 ,,	
	9 ,, mixtures.	

For P 3 and P 4, the number remained constant throughout, with the exception of one individual which was an obvious malformation.

Thus by crossing a male and female of the same species with the same spine-formulæ individuals with no less than nine different spine-formulæ were obtained.

No. 3. The last cross to be considered is one in which the parents were taken from the same original culture as the two previous, but the spine-formulæ for the parents were again different:

S.F. for original female . .	3 . 4 . 3 . 3
S.F. for male .	2 . 4 . 3 . 3
S.F. for female	$\frac{3.4.3.3}{2.4.3.3}$

Cross was made on June 3rd. Nauplii separated on June 5th. Adults first observed on June 25th. The culture was examined on June 28th.

	Number.	S.F.			
Females .	2	3 . 4 . 3 . 3			
	1	2 . 4 . 3 . 3			
	3	Mixtures	$\frac{3.4.3.3}{3.3.3.3}$,	$\frac{3.4.3.3}{2.4.3.3}$,	$\frac{2.4.3.3}{2.3.3.3}$
Males ..	2	3 . 4 . 3 . 3			
	1	2 . 4 . 3 . 3			
	2	2 . 3 . 3 . 3			
	1	Mixture	$\frac{3.3.3.3}{3.4.3.3}$		

It will be seen that in this cross only 12 individuals reached maturity.

Further Experiments and Discussion of the Results.

A great many other crosses were made, but in every case the results obtained were very similar. In addition, a great many other adult parents were taken direct from the ponds and their offspring examined. In no single case was it found that the spine-formula was strictly that of the parents.

Again, it was very definitely established that the spine-formula was determinable at quite an early stage and that in no case did any female reach the sexually mature stage while the spine-formula was immature—this was proved by taking adult females with a small spine-formula, such as 2 . 3 . 3 . 3, and keeping them for four weeks. They continued to give rise to egg-sacs, but the spine-formula remained unchanged.

This observation was also made with *Cyclops americanus* (8).

Discussion of Results.

A glance at the figures will show that they do not agree with any simple Mendelian formula, even if we make almost any assumption with regard to those that did not reach maturity. The number of eggs produced by one individual in *Cyclops lacunæ* is always about 48. These do not all hatch, and it is difficult to prevent a considerable mortality during the early stages. Again, it is not unusual for the adult to eat her own offspring, as recorded by Manfredi (10).

There is, in my opinion, only one possible solution if the varieties as indicated by spine-formulæ on being crossed are to agree with any Mendelian law.

It will be noticed that the spine-formula for P 1 and P 2 changes considerably, while that for P 3 and P 4 is constant, and we need therefore only consider the first two pairs of limbs. Now each pair of swimming-feet is a *pair*, and therefore there are two joints that correspond exactly, one on each side of the animal, and these are the only joints with which we are here concerned.

Confining our attention to P 1 for a minute, the only two variations that occur are *two spines* or *three spines*, and these characteristics can quite conceivably be conveyed by factors.

Now, it would certainly appear from the figures given that the spine-numbers for P 1 and P 2 are quite independent, and if this spine-number is a characteristic that is capable of acting in accordance with the laws of Mendel there are independent factors for P 1 and P 2.

Now, since the number of spines on P 1 may be 2 or 3, while that on P 2 may be 2, 3, or 4, it is possible that in P 1 we are dealing with two pairs of factors, while in P 2 we are dealing with three pairs, and this may possibly account for the complication that exists and the great number and variety of individuals resulting from one cross.

The next point that requires an explanation is the asymmetry in spine-formula that can be found in an individual. These are, of course, what are referred to as mixtures in the accounts of the crosses.

Now, if the spine-numbers 2 and 3 are characteristics conveyed by factors, we should rather naturally expect one to be dominant and the other recessive, but it is quite conceivable that neither is dominant nor recessive, and it is interesting to speculate what would therefore be the result of a cross if this were the case. Whether it is conceivable that this could be the cause of the asymmetry or not I am quite incapable of judging, but, if such a thing is possible, it certainly offers a simple solution to the problem.

There is, of course, another and perhaps more probable solution, and that is that we are dealing with the influence of such things as the result of confining the larvæ to a small space, etc., or the gradual increase in pH.

Taking the first of these alternatives, it would seem that it offers no explanation, from the fact that the figures given for the spine-formulæ are not figures that are produced in the laboratory only. A careful search in the pond where these animals live has revealed a number of individuals with practically every spine-formula obtained during the culture experiments, nor is this asymmetry confined to the one species.

A careful study of spine-formulæ has shown me that even on such a well-known species as *Cyclops prasinus*, the spine-formula may show mixtures comparable to those of *Cyclops lacunæ*; and Ziegelmayer (11) has drawn attention to the asymmetry to be found in the two fifth swimming-feet of *C. viridis*, Jurine. He apparently attributes much of the abnormality, however, to the prevalence of epizoa, with which *C. viridis* is so often covered. This explanation can have no place here, since one of the great advantages of breeding the animals in the way advocated is that epizoa do not occur, possibly due to the high pH value of the water, since, as indicated by Saunders (12), certain protozoa (e. g., *Spirostomum*) are killed when pH reaches 7·8.

With regard to the influence of pH directly on the spine-formulæ, I have pointed out elsewhere (13) that it has little or no influence. With *Cyclops lacunæ*, as with so many other species, the animals are found in nature with a range of pH greater than that produced during the breeding-experiments, the present range noted for the species in question being 6·3–8·2. Nor is it likely that alteration in pH should have such profound influence on some of the feet and not on the others. Nor, again, can it account for the asymmetry, unless we regard all the *mixtures* as pathological monstrosities, and this supposition hardly agrees with the occurrence of such mixtures in nature as well as in the laboratory.

Finally, it should be pointed out that the possibility of the spine-formulæ being affected by the experimental conditions was not overlooked, and control experiments were carried out.

Control Experiments.

In order to ascertain if the conditions under which the animals were bred were in any way responsible for the results obtained, two other well-known species were treated in exactly the same way.

The species chosen were :—

Pachycyclops annulicornis (Koch). Syn. *Cyclops albidus* (Schmeil).

Pachycyclops signatus (Koch). Syn. *Cyclops fuscus* (Schmeil).

These two species have definite characteristics, and the spine-formulæ and details of the spines and setæ lend themselves to very detailed observation.

Adult females of both these two species were taken in the field and their eggs hatched. The nauplii were treated in exactly the same way as those of *C. lacunæ* and *C. americanus*, except that the cultures were left a little longer.

At the end of 32 days, the cultures were examined very closely, and I was unable to detect any difference in spine-formulæ or in the details of the spines and setæ between the adults reared in the incubator and those collected in the field.

It is unlikely, therefore, that the conditions of the experiment were responsible for the results given by *C. americanus* and *C. lacunæ*.

Conclusion.

As the results of breeding-experiments it has been shown that the spine-formula in certain species of *Cyclops* is not sufficiently constant to be of importance as a specific characteristic, and from this it follows that the naming of new species from preserved material in which the spine-formula is largely used requires considerable caution.

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XIX.—*New or little-known* Tipulidæ (*Diptera*).—XXXIV. *Australasian Species.* By Charles P. Alexander, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

In the present instalment the writer has continued his consideration of the Australian and Tasmanian species of the great genus *Molophilus*. The species herein described belong for the most part to the *ruficollis* subgroup of the *gracilis* group, the typical form of which (*ruficollis*, Skuse) was figured in the preceding part under this general title. In this subgroup, which is very extensively developed in Australia and Tasmania, the ventral lobe of the basistyle is the only one that is well preserved and it is unarmed at the apex. The only known species of the *verticalis* group (*verticalis*, sp. n.) is likewise described at this time. This group is distinguished by the great development of the dorsal lobe of the basistyle, which is produced at apex into a spinous point or blade.

As before, the majority of the species discussed at this time were collected in New South Wales, Victoria, South Australia, and Tasmania by Dr. André Tonnoir, to whom the types have been returned. Additional species were collected by Messrs. Walter Heron, Ferguson, and Mackerras in New South Wales, and by Mr. Hardy in Tasmania. I express my sincere thanks to the above-named gentlemen for their kind co-operation in making known this rich crane-fly fauna.

Molophilus amiculus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration pale brownish yellow; halteres with brown knobs; wings tinged with greyish yellow, the base and costal region more saturated yellow; male hypopygium with the ventral lobe of the basistyle unarmed apically; outer dististyle short-stemmed, the two arms conspicuous, one acutely pointed; basal dististyle a pale arcuated blade with four small spinous tubercles near apex.

Male.—Length (excluding head) about 3 mm.; wing 4·3 mm.

Head of the unique type lacking.

Pronotum brownish testaceous. Mesonotum pale brownish yellow, shiny, with conspicuous erect black setæ. Pleura more yellowish. Halteres pale, with brown knobs. Legs

with the coxæ and trochanters pale yellow; femora brown, paler basally; fore legs broken; tibiæ and tarsi passing into darker brown. Wings tinged with greyish yellow, the base and costal region more yellowish; veins a trifle darker, with relatively sparse and short brown setæ. Venation: *r* ending about opposite *r–m*; vein *2nd A* ending about opposite the caudal end of the oblique *m–cu*.

Abdomen pale brown, the hypopygium somewhat more yellowish. Male hypopygium with the ventral lobes of basistyle prolonged into a slender lobe, the tip unarmed except for a cluster of four or five setæ; outer face of style with scattered setæ, the mesal edge with tiny erect setulæ. Outer dististyle bifid, the stem paler than the arms, relatively short and stout, the outer arm a long, slender, black spine that is about equal in length to the stem, the tip acute, just before apex on the mesal face with a microscopic denticle; inner arm much shorter, dilated into a broadly oval blade, the outer edge thinner and paler. Basal dististyle a flattened arcuated blade, a little dilated beyond the base, the tip narrowly darkened, before the apex with an oblique linear row of four small tubercles, each set with a stout microscopic spine. Ædeagus long, straight, slender, about one-half longer than the basal dististyle.

Hab. Tasmania.

Holotype, ♂, King River, altitude 500 feet, February 4, 1923 (*A. Tonnoir*).

Molophilus ampliatus, sp. n.

Male.—Length about 3·3 mm.; wing 4·2–4·3 mm.

Female.—Length about 3·2 mm.; wing 4·5 mm.

Closely allied to *M. lucidipennis*, Skuse, differing chiefly in the structure of the male hypopygium.

Lateral pretergites of præscutum a trifle brightened. Halteres pale, the knobs faintly infuscated, the setal covering dark. Wings with *m–cu* beyond the fork of *M*.

Male hypopygium with the ventral lobe of the basistyle produced into a relatively short blade that is slightly dilated outwardly and obliquely truncated at apex; margin of apex with a delicate fringe of setulæ and scattered conspicuous setæ; outer face of style with a few scattered setæ. Outer dististyle smaller, the apex darkened, the apical spine gradual, gently curved, the basal spine a little smaller, but long and acute, the margin of the style between these two spines U-shaped; basad of the basal spine, near mid-length of the style, a long, slender, digitiform lobule, pale in colour,

provided with a couple of setigerous punctures. Inner dististyle quite as in *lucidipènnis*, bent upon itself near base, the long distal portion sinuous, the tip acute. Ædeagus long, slender, in slide-preparations appearing almost straight, extending caudad to opposite two-thirds the length of the dilated ventral lobe of the basistyle.

The female has the antennæ correspondingly shorter, the flagellar segments short-oval. Ovipositor and genital segment reddish horn-colour; tergal valves of ovipositor long, slender, the tips bent slightly upwards.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 10, 1923 (*A. Tonnoir*).

Allotype, ♀, Mt. Field, December 18, 1922 (*A. Tonnoir*).

Paratopotypes, 7 ♂♂, 2 ♀♀, January 10–13 and 24–27, 1923; *paratypes*, 1 ♂, with the allotype, 1 ♂, Adventure Bay, December 31, 1922 (*A. Tonnoir*).

Molophilus exiguus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; size small (wing, ♂, under 3 mm.); general coloration testaceous brown, the pleura dark greyish brown; vein *2nd A* short and straight, ending some distance before the short transverse *m–cu*; male hypopygium with the basistyle unspined at tip; basal dististyle bifid.

Male.—Length about 2·3 mm.; wing 2·6 mm.

Rostrum and palpi brownish black. Antennæ (♂) of moderate length, if bent backward extending to shortly beyond the wing-root; scapal segments ochreous brown, the flagellum dark brown; flagellar segments oval with a conspicuous, erect, pale pubescence. Head grey.

Pronotum brownish testaceous, the làteral pretergites narrowly yellowish. Mesonotal præscutum light testaceous brown, the median line narrowly greyish; pseudosutural foveæ linear, shiny reddish brown; scutum and scutellum concolorous with the præscutum, the postnotum dark greyish brown. Pleura dark greyish brown. Halteres relatively short, brownish testaceous, the stem a little darker. Legs with the coxæ and trochanters brown; femora and tibiæ testaceous brown, with dark setæ, the tarsal segments passing into brown; fore legs broken. Wings comparatively narrow, with a light yellow tinge, the veins brownish yellow with slightly darker brown macrotrichiæ. Venation: *r* approximately in alignment with *r–m*, the latter connecting with R_5 shortly beyond its origin; vein *2nd A* unusually short and

straight, ending some distance before the short transverse *m–cu*.

Abdomen dark brown, including the hypopygium. Male hypopygium with the ventral lobe of the basistyle produced caudad into a broad fleshy lobe, the mesal-apical angle more conspicuously setiferous than the remainder, but otherwise unarmed. Dististyles two, arising close together, the outer with a long stem, shallowly bifid at apex, the outer arm gently curved, the apex truncated and blackened; inner arm a triangular arched blade. Basistyle a little longer and stouter, gently curved to the acute blackened apex, before the tip with a slender acute spine; apex of style beyond the spine about twice the length of the latter. Ædeagus relatively short but slender, arcuated.

Hab. Tasmania.

Holotype, ♂, Zeehan, altitude 200–300 feet, February 1924 (*G. H. Hardy*); collector's number 372.

Type in the collection of the Queensland University Museum.

Molophilus adamantinus, sp. n.

Male.—Length about 3·2 mm.; wing about 4 mm.

Closely allied to *M. exiguus*, sp. n., from which it differs especially in the larger size and wing-venation. The structure of the male hypopygium is very similar in the two species.

Antennæ shorter, if bent backward scarcely attaining the wing-root; scapal segments ochreous, the flagellar segments dark brown, oval. Præscutum narrowly pruinose laterally; scutal lobes each with two darker dashes, the median area slightly greyish. Pleura reddish brown, sparsely pruinose. Halteres pale, the knobs more infuscated. Legs with the femora pale, darkened toward the tip; tibiæ yellow, the tips and a conspicuous, dilated, subbasal ring on fore tibia (♂) darkened; tarsi pale, passing into brown at tips. Wings rather broad, with a pale yellowish tinge, the veins darker yellow; macrotrichæ pale brown. Venation: *r* lying proximad of *r–m*, the basal section of R_{2+3} very short and strongly arcuated; vein *2nd A* long, ending nearly opposite the cephalic end of the long oblique *m–cu*. Abdomen dark brown, the hypopygium a trifle lighter in colour. Male hypopygium very similar in colour to that of *M. exiguus*, differing only in minor details. Basal dististyle longer and more slender, the apical spine longer, more slender, and gently curved at tip, the lateral spine erect, placed at about two-thirds the length of the style.

Hab. Tasmania.

Holotype, ♂, Lake Margaret, altitude 2500 feet, February 3, 1923 (*A. Tonnoir*).

The most obvious differences between the present species and *M. exiguus* lie in the shorter antennæ, the venation, especially the longer vein *2nd A* and the long oblique *m–cu*, and the hypopygium.

Molophilus apricus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration dark brown; antennæ short, dark throughout; anterior lateral pretergites conspicuously light yellow; halteres infuscated, the knobs conspicuously light yellow; wings with a strong brownish tinge, the veins darker brown; male hypopygium with the basistyle short and stout, the ventral lobe broad and flattened, the dististyles lying at its base, both heavily blackened, the basal style terminating in an acute sickle-shaped point.

Male.—Length about 4·5–4·6 mm.; wing 5·5–6 mm.

Female.—Length about 5 mm.; wing about 5·5 mm.

Rostrum brown, the palpi darker brown. Antennæ short, if bent backward not attaining the wing-root, brownish black throughout; flagellar segments short-oval to short-cylindrical, in the male appearing almost moniliform. Head dark brownish grey, with relatively short yellow setæ; a more or less distinct ochreous spot behind each antennal fossa.

Pronotum obscure yellow. Anterior lateral pretergites clear light yellow, the posterior pretergites obscure. Mesonotum dark grey, the præscutum with a narrow dark brown median stripe that is slightly narrowed behind; humeral region strongly tinged with reddish; scutellum with a reddish cast. Pleura dark leaden-brown, including the dorsopleural membrane; tegular region restrictedly yellow. Halteres infuscated, the knobs abruptly and conspicuously light yellow. Legs with the coxæ leaden-brown, the fore coxæ a little paler; trochanters dark brown; remainder of legs dark brown, the terminal tarsal segments passing into black. Wings with a strong brown tinge, the veins conspicuously darker brown. Venation: *r* lying some distance beyond the level of *r–m*; *m–cu* unusually long, sinuous, longer than the short petiole of cell M_1; vein *2nd A* gently sinuous, extending to just beyond the cephalic end of *m–cu*.

Abdomen dark brown, including the hypopygium, the latter with conspicuous fringes of yellow setæ on the tergum and ventral lobe of basistyle. Male hypopygium with the basistyle very short and stout, the ventral lobe relatively short and wide, flattened, the apex obtuse and fringed with

yellow setæ. The dististyles lie at the base of this ventral lobe, appearing unusually open and exposed; outer style a small, arcuated, black rod, the apex shallowly bifid; inner dististyle longer, the base stouter and nearly straight, the apical half or less more slender, sickle-shaped, narrowed to the acute apex; between these two styli lies a small, acute, tooth-like spine. In a position of rest, the sickle-shaped ends of the basal dististyles lie decussate across the genital chamber.

In the female that is associated with this species, the petiole of cell M_3 is somewhat longer and there are other slight differences from the male.

Hab. Tasmania.

Holotype, ♂, Strahan, February 5, 1923 (*A. Tonnoir*).

Allotype, ♀, Adventure Bay, January 1, 1923 (*A. Tonnoir*).

Paratopotype, ♂, February 1924 (*G. H. Hardy*), collector's number 399; *paratype*, ♂, Geeveston, December 8, 1922 (*A. Tonnoir*).

The paratopotype is in the collection of the University of Queensland.

Molophilus cerberus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration dark brown; antennæ relatively short; legs and wings brown; male hypopygium with the outer dististyle deeply bifid, the outer arm long, slender, sinuous, approximately four times the length of the short straight inner arm.

Male.—Length 4·5 mm.; wing 5·4–5·8 mm.

Female.—Length about 5·5–5·7 mm.; wing 7·7–7·8 mm.

Rostrum and palpi brownish black. Antennæ relatively short, if bent backward (♂) not attaining the wing-root, brownish black throughout; flagellar segments oval, with a short pale pubescence and relatively short verticils. In the female the antennæ are a little shorter with the basal segments a trifle paler. Head dark grey, with numerous short yellow setæ.

Pronotum dark brownish grey. Lateral pretergites conspicuously light sulphur-yellow, narrowly interrupted just beyond the pseudosutural foveæ, becoming more conspicuous at the tegular region. Mesonotum dark plumbeous brown. Pleura similar, the dorso-pleural membranes conspicuously light yellow. Halteres pale, the knobs light yellow. Legs with the coxæ concolorous with the pleura; trochanters brown; remainder of legs dark brown; fore tibiæ (♂) with

a slightly enlarged sub-basal ring. In the female the femora and tibiæ are more yellowish, the terminal tarsal segments passing into dark brown. Wings with a strong brown tinge, the longitudinal veins more or less seamed with darker; veins slightly darker brown, especially R_5 ; macrotrichiæ darker brown. Venation: *r* lying approximately opposite *r–m* ; vein *2nd A* relatively long, ending opposite one-half to one-third the length of the petiole of cell M_3. In the female, vein *2nd A* is even longer, in cases extending almost to the base of cell M_3.

Abdomen brownish black, with conspicuous yellow setæ ; hypopygium dark, with long yellow setæ. Male hypopygium relatively short and stout, the basistyle with the ventral lobe produced into a stout finger-like appendage. Dististyles somewhat approximated at base, the outer style with a long slender stem, bifid at apex, the outer arm long, slender, strongly curved to the acute tip ; inner arm a short blunt spur that is only about one-fourth the length of the outer arm. Basal dististyle a long, slender, gently curved rod, the tip acute, the ventral margin with microscopic appressed spinules, the base of the style more dilated. Ædeagus relatively short. Ovipositor with the valves very long and slender, strongly upcurved to the acute tips ; sternal valves long and slender, straight.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 11, 1923 (*A. Tonnoir*).

Allotopotype, ♀, January 16, 1923 (*A. Tonnoir*).

Paratopotypes, 3 ♂♂, 1 ♀, January 16–27, 1923 (*A. Tonnoir*).

Molophilus erebus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup ; general coloration dark brown ; antennæ of male of moderate length ; wings with a strong brown tinge, broadly washed with paler before the cord ; petiole of cell M_3 short ; male hypopygium with the ventral lobe of basistyle slender, tapering ; basal dististyle a simple sinuous rod, the apex dilated into a blade.

Male.—Length about 4·5–5 mm. ; wing 5·5–6·5 mm.

Female.—Length about 5·5 mm. ; wing 7·3 mm.

Rostrum and palpi dark brown. Antennæ (♂) relatively elongate, if bent backward extending to about opposite the second abdominal segment ; flagellar segments elongate-oval to fusiform, with a conspicuous, erect, white pubescence and subequal unilaterally arranged black verticils. In the female

the antennæ are shorter, but still extend to beyond the wing-root. Head dark brownish grey.

Pronotum obscure brownish yellow, the anterior lateral pretergites narrowly obscure yellow. Mesonotum dark brown, the humeral region of the præscutum restrictedly obscure yellow; pseudo-sutural foveæ black. Pleura dark brown, the dorso-pleural membrane a little paler. Halteres with the extreme base and knobs light yellow, the remainder of the stem weakly infuscated. Legs with the coxæ weakly infuscated, especially the posterior coxæ; trochanters obscure yellow; femora yellowish brown, the tips narrowly infuscated; tibiæ light brown, the tips narrowly infuscated; terminal tarsal segments passing into darker brown; hind tarsi shorter than the tibiæ. Wings with a strong brown tinge, with conspicuous paler washes before the cord and in cells *Cu* and *1st A*; veins darker than the ground-colour, especially R_5 and Cu_1; macrotrichiæ dark brown. Venation: *r* lying some distance beyond the level of *r–m*; basal section of R_{2+3} nearly twice as long as R_5; petiole of cell M_3 short, about equal to or a little longer than the weakly sinuous *m–cu*; vein *2nd A* relatively elongate, ending about opposite mid-length of the petiole of cell M_3.

Abdomen dark brown, including the hypopygium. Male hypopygium with the ventral lobe of basistyle very long, slender, tapering gradually to the narrowly obtuse apex, the mesal face with abundant delicate erect to retrorse setulæ; dorsal lobe of basistyle broadly expanded. Outer dististyle slender, bifid at apex, the outer arm a narrow, flattened, curved blade, the inner arm a small dilated blade. Basal dististyle very conspicuous, simple, the basal half or more slender, sinuous, then dilated into a broad, flattened, curved blade, the apex gradually narrowed to an acute point, the outer margin of the blade microscopically serrulate; face of blade covered with abundant microscopical setulæ. Ovipositor with the bases darkened, the tergal valves yellowish, very elongate.

Hab. Tasmania.

Holotype, ♂, Zeehan, February 7, 1923 (*A. Tonnoir*).

Allotype, ♀, Cradle Valley, January 12, 1923 (*A. Tonnoir*).

Paratypes, 1 ♂, 1 ♀, with the allotype, January 12–26, 1923 (*A. Tonnoir*).

Molophilus lyratus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; antennæ short; head pale brownish yellow, the anterior vertex almost fulvous; knobs of halteres yellow; fore tibiæ (♂) with a

conspicuous subbasal black ring; male hypopygium with a conspicuous lyriform structure, the arms protruding between the large ninth tergite and the long narrow basistyles.

Male.—Length about 5 mm.; wing 6 mm.

Rostrum pale brown; palpi dark brown. Antennæ short, if bent backward extending to just beyond the wing-root; scapal segments ochreous; flagellar segments brown, passing into darker brown outwardly; flagellar segments oval, clothed with a very short inconspicuous pubescence and longer conspicuous verticillate setæ that are a little longer than the segments themselves. Head pale brownish yellow, the anterior vertex almost fulvous, the orbits narrowly pale yellow.

Pronotum yellow, the lateral pretergites paler yellow, this colour becoming obsolete near the level of the pseudosutural foveæ. Mesonotal præscutum yellowish grey, with three broad, subconfluent, brown stripes, restricting the colour to the interspaces and laterally; humeral region vaguely brightened; scutum brown, the lobes darker laterally and posteriorly, the posterior lateral region of each produced into a small yellow tubercle to the wing-base; scutellum vaguely more yellow; postnotal mediotergite brown, the lateral margins with a narrow strip of yellow on either side. Pleura brown, the sterno-pleurite and meron more reddish brown, the anepisternum darker. Halteres pale, the knobs yellow. Legs with the coxæ and trochanters reddish brown; femora yellow, the tips infuscated; tibiæ brownish yellow, the tips infuscated; fore tibia (♂) with a conspicuous, feebly dilated, subbasal, black ring that is a trifle more than its own length beyond the base; basitarsi pale brown, the remainder of the tarsi darker brown. Wings with a strong yellowish tinge, the veins darker yellow; macrotrichiæ pale brown, only moderately long and dense. Venation: vein *2nd A* moderately long, extending to a short distance beyond the base of the petiole of cell M_3.

Male hypopygium relatively long and narrow, of very unusual structure. Ninth tergite large, arched, narrowed apically, appearing as a conical plate with the apex narrowly truncated. From beneath this plate arises a remarkable lyriform chitinized structure that presumably represents a phallosome, the two arms slender, narrowed gradually to the acute tips which jut caudad from between the tergal plate and the elongate basistyles. Basistyles ventral, slender, lying parallel and closely approximated, the apex of each obtuse, unarmed, provided with rather abundant delicate yellow setæ. Outer dististyle relatively small, the apex slender blackened

a subbasal more flattened and obtuse arm of approximately equal length. Basal dististyle a nearly straight powerful black rod, the extreme apex a little enlarged and provided with two or three obtuse teeth on the lower or inner face; lower face of style with a conspicuous sub-basal spine directed toward the apex of the style, the axil densely set with black spinous pegs that extend in a row along the lower face of the style almost to the tip. Ædeagus slender, extending caudad to opposite the tips of the lyre.

Hab. Tasmania.

Holotype, ♂, Hobart, January 13, 1923 (*A. Tonnoir*).

Molophilus perdistinctus, sp. n.

Belongs to the *plagiatus* group; general coloration dark brown; antennæ of male elongate, the flagellar segments only moderately enlarged at base; wings tinged with brown; male hypopygium with the basal dististyle small, slender, bent into a boomerang-shaped structure; gonapophyses fused into a blackened central mass that terminates in two strong horns.

Male.—Length about 4 mm.; wing 5 mm.

Female.—Length about 4·5 mm.; wing 5·2 mm.

Rostrum and palpi dark brown. Antennæ (♂) elongate, in the unique type broken at the eighth segment, if entire presumably extending to opposite mid-length of the abdomen; flagellar segments fusiform, the base of each segment only feebly enlarged, gradually narrowed to the short, shiny, terminal pedicel; antennæ dark brown throughout, with a conspicuous erect white pubescence and unilaterally arranged verticils. Head dark brown.

Thorax dark brown, the humeral region of the præscutum only narrowly and indistinctly brightened. Halteres dark, the knobs brown. Legs with the coxæ yellow, the fore coxæ more infuscated; trochanters yellow; remainder of legs brownish yellow, the tarsi passing into brown, the segments with brown macrotrichiæ, some of which are suberect. Wings with a uniform brown tinge, the veins darker brown; veins R, R_5, and Cu_1 darker; macrotrichiæ darker brown. Venation: *r* lying a short distance beyond *r–m*; vein *2nd A* extending to shortly beyond the origin of the petiole of cell M_3, the veins only slightly sinuous and closely paralleling the anal margin of the wing.

Abdomen dark brown, including the hypopygium. Male hypopygium with the basistyles produced apically into a small tubercle that is further produced into a small chitinized beak, the whole structure suggestive of the head

and beak of a bird, the tubercle beset with delicate setæ. Diststyles widely separated at origin by membrane; outer diststyle a powerful blackened rod, gently curved, the apex terminating in two points, the outer a short straight arm, the inner a little longer, gently curved. Basal diststyle very slender, small, shaped somewhat like a boomerang, the bend at near one-third the length, the distal two-thirds a little enlarged, the apex blunt, the surface of the style with a few microscopic punctures. Gonapophyses fused into a massive blackened central mass, the caudo-lateral angles produced into conspicuous horns; in the unique type one horn is gently curved, the other directed caudad. Ædeagus very small. Ninth tergite an oval setiferous lobe. Ovipositor with the tergal valves slender, gently upcurved to the acute tips.

Hab. Tasmania.

Holotype, ♂, Cradle Mt., January 27, 1923 (*A. Tonnoir*).

Allotopotype, ♀.

Molophilus inelegans, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration dark brown, the pleura conspicuously dark grey; halteres obscure yellow; legs light yellowish brown, the tips of the tarsi darker; wings with R_{4+5} short; male hypopygium with the gonapophyses and ædeagus very long and slender.

Male.—Length about 3·8 mm.; wing 4·7 mm.

Rostrum and palpi dark brown. Antennæ relatively short, if bent backward scarcely reaching the wing-root; scapal segments light brown, the flagellum darker brown; flagellar segments oval, with a dense erect pale pubescence. Head dark brownish grey.

Pronotum dark. Lateral pretergites pale whitish yellow, becoming darkened beyond the level of the pseudosutural foveæ. Mesonotum uniformly dark brown, the setæ of the præscutum small and inconspicuous; pseudosutural foveæ elongate, shiny reddish brown; humeral region a little tinged with reddish; scutellum more testaceous brown; postnotum dark grey. Pleura uniformly dark grey, the dorso-pleural membrane dark. Halteres obscure yellow. Legs with the coxæ and trochanters obscure yellow; femora light yellowish brown, with relatively sparse and inconspicuous darker brown trichiæ; tibiæ yellowish brown, the tips narrowly darker; fore tibiæ (♂) with the basal region very slightly dilated, but not darkened; tarsi passing into dark brown. Wings slightly greyish, the veins brown;

macrotrichiæ darker brown. Venation: *r* lying almost opposite or just beyond *r–m*, the basal section of R_{2+3} short, arcuated; R_{4+5} very short, not much longer than *r–m*; vein *2nd A* ending opposite the base of the petiole of cell M_3.

Abdomen dark brown, the hypopygium a little paler, especially the tips of the styli, which appear bleached. Basistyles relatively stout, the base with relatively small setæ, the apex rather abruptly narrowed into a pale flattened lobe with more numerous conspicuous setæ. Outer dististyle dusky, a slender rod, the basal half arched into a half-cylinder, the apex gradually narrowed to the subacute tip. Inner dististyle with the stem strongly curved, the apex dilated into a conspicuous pale flattened blade that bears two spines, a larger one near the base on the lower margin, and a small straight spine placed more distally on the upper margin; disk of the blade with about fifteen delicate setiferous punctures. Gonapophyses very powerful, appearing as slender curved horns, the tips more blackened, acute. Ædeagus exceedingly elongate, slender, arcuated, in a position of rest jutting beyond the other elements of the hypopygium, shortly before its apex a little dilated.

Hab. New South Wales.

Holotype, ♂, Waterfall, November 1921 (*A. Tonnoir*).

M. inelegans is allied to *M. froggatti*, Skuse, and *M. gigas*, Alexander.

Molophilus poliocephalus, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration reddish brown, the head brown with a conspicuous blue-grey area on centre of vertex; wings greyish yellow, the base darkened; male hypopygium with the inner dististyle terminating in a long spine with a small acute spine in its axil.

Male.—Length about 3 mm.; wing 3·5 mm.

Female.—Length about 3·5 mm.; wing 3·7 mm.

Rostrum and palpi brownish black. Antennæ of male moderately elongate, if bent backward extending to just before the base of the abdomen; first scapal segment dark, the second scapal and basal flagellar segments yellow, the terminal segments passing into pale brown; flagellar segments (♂) elongate-fusiform, with a conspicuous erect white pubescence and with unilaterally arranged verticils. In the female, the antennæ are shorter, pale almost to the end. Head brown, the vertex with a conspicuous blue-grey area.

Mesonotum pale to dark reddish brown, the lateral margin of the præscutum narrowly yellowish, the posterior sclerites of the mesonotum slightly pruinose. Pleura dark brown. Halteres pale, the knobs testaceous yellow. Legs with the coxæ brownish testaceous; trochanters yellow; remainder of legs pale brown, the apices of the tibiæ narrowly darkened, the terminal tarsal segments darker. Wings with a greyish-yellow tinge, the costal region clearer yellow, the base conspicuously darkened, this colour including the basal third of cell *2nd A*; veins darker yellow than the ground-colour. Macrotrichiæ relatively dense, brown. Venation: *r* lying beyond the level of *r–m*, the basal section of R_{2+3} thus being nearly one-half longer than R_{4+5}; vein *2nd A* terminating about opposite the caudal end of *m–cu*.

Abdominal tergites dark brown, the sternites more reddish brown, the caudal margins of the segments narrowly paler, more evident in the male; in the female, the tergites with a more or less distinct longitudinal dark median line. Male hypopygium with the basistyles relatively stout, the ventral lobe prolonged caudad beyond the level of the dististyles, appearing flattened to subclavate, the mesal face with conspicuous erect setæ and abundant microscopic setulæ. Dististyles placed close together in the notch at the base of the lobe of the basistyle; outer dististyle a massive, subquadrate, fleshy lobe that has two rows of setiferous tubercles along the mesal face, each of these rows terminating in a powerful spine; the entire surface of this style is closely set with microscopic setulæ, in addition to the larger setæ. Inner dististyle longer, the base dilated, a little less than the apical half bent at a right angle and gradually narrowed into a long chitinized point, the outer margin near the bend with a few microscopic tubercles; in the axil of the bend a smaller, acute, black spine. Ædeagus relatively slender and elongate. Ovipositor with the tergal valves nearly straight.

Hab. New South Wales.

Holotype, ♂, Dorrigo, 1922 (*Walter Heron*).

Allotopotype, ♀.

Type in the writer's collection.

Molophilus capitatus, sp. n.

Closely allied to *M. poliocephalus*, sp. n., differing chiefly in the structure of the male hypopygium.

Male.—Length about 3·8 mm.; wing 4·5 mm.

Rostrum and palpi brownish black. Antennæ with the scapal segments dusky at base, the tips broadly light yellow,

the flagellum brownish black; flagellar segments elongate-oval, with a conspicuous erect white pubescence and unilaterally arranged black verticils. Head light yellow, the centre of the vertex with a conspicuous blue-grey area.

Pronotum light yellow, with a small dorso-median brown spot, the lateral margins infuscated. Lateral pretergites narrowly whitish yellow. Mesonotal præscutum rather light brown, the margins paler; scutellum and postnotum more testaceous brown; thoracic setæ relatively sparse and short. Pleura light brown. Halteres pale, the knobs light yellow, the stem a little infuscated. Legs with the coxæ and trochanters yellowish testaceous, the posterior coxæ brighter; femora brown, the bases broadly paler; tibiæ pale brown, the tips darkened; fore tibia (♂) with a relatively narrow, shiny, black sub-basal ring; tarsi passing into brownish black. Wings with a faint yellowish-brown tinge, the base not conspicuously darker; veins and macrotrichiæ darker brown. Venation: *r* almost opposite *r–m*; vein *2nd A* ending opposite *m–cu*.

Abdomen brown, the hypopygium more yellowish. Male hypopygium with the ventral lobe of the basistyle armed with longer stouter setæ. Outer dististyle similar to that in *M. poliocephalus*, the outer tooth simple, the lower or more basal tooth flattened into a serrulate plate; a curious, flattened, ribbon-like structure appears to arise from this style, directed caudad, the tip a small spine, before the apex on either side with small serrations. Inner dististyle with the axillary spine smaller. The long ribbon-like appendage on the outer dististyle of the male hypopygium does not occur in *poliocephalus*, being replaced by a microscopic spur.

Hab. South Australia, New South Wales.

Holotype, ♂, Adelaide, South Australia, October 20, 1921 (*A. Tonnoir*).

Paratype, ♂, Woy Woy, New South Wales, September 2, 1923 (*I. Mackerras*); specimen returned to Dr. E. W. Ferguson.

Molophilus tortilis, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; closely allied to *M. poliocephalus*, sp. n.; head cream-yellow, the centre of the vertex with a large oval grey spot; male hypopygium with the ventral lobe of the basistyle with very long setæ; inner dististyle forked to mid-length, the arms sinuous.

Male.—Length about 3·8 mm.; wing 4·7 mm.

Rostrum and palpi brownish black. Antennæ dark brown,

the flagellum broken. Head light cream-yellow, the centre of the vertex with a large oval grey spot.

Pronotum light sulphur-yellow. Mesonotum reddish brown, the præscutum with a faint bluish cast; pseudosutural foveæ dark reddish brown, but little evident against the ground-colour; lateral pretergites light sulphur-yellow; scutellum a trifle more testaceous. Pleura dark brown. Halteres dusky, the knobs infuscated. Legs with the coxæ and trochanters testaceous; remainder of legs dark brown, the fore legs broken. Wings with a faint dusky tinge, the veins a little darker, the macrotrichiæ dark brown. Venation: vein *2nd A* ending opposite or a very short distance beyond *m–cu*.

Abdomen dark brown, the hypopygium more yellowish. Male hypopygium with the ventral lobe of the basistyle well developed, slender, the mesal face with very long, powerful, erect setæ, these only a little shorter than the lobe itself; other lobes of basistyle poorly developed. Outer dististyle a short, powerful, clavate lobe, entirely darkened, the base narrow, widened to a collar before the apex, the conical tip suddenly produced, sparsely setiferous; the collar-like ring is produced on the outer margin into a black, gently curved, spiny lobe. Inner dististyle elongate, very deeply forked, the longest arm about as long as the stem, strongly twisted at base, thence extended into a long straight spine; inner arm shorter than the stem, the apex blackened, the extreme tip suddenly curved, acute. Ædeagus relatively long and slender.

Hab. New South Wales.

Holotype, ♂, Balmoral, near Sydney, May 19, 1923 (*E. W. Ferguson*); Collector's No. 80.

Type returned to Dr. Ferguson.

Molophilus sigma, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration light reddish brown; basal segments of antennæ yellow; head yellow, the centre of the vertex with a small grey spot; ventral pleurites dark brown; knobs of halteres light yellow; male hypopygium with the outer dististyle an oval, densely setiferous lobe, with a powerful, curved, black spine at base; basal dististyle a long, simple, strongly sinuous rod, extended at apex into a blackened spine.

Male.—Length about 3·5 mm.

Rostrum and palpi brownish black. Antennæ moderately elongate, if bent backward extending to shortly beyond the

wing-root; scapal segments light yellow, flagellum pale brown; flagellar segments long-oval, with a dense erect pale pubescence and unilaterally arranged setæ. Head largely yellow, the centre of the vertex with a pruinose area; occiput darkened; genæ infuscated.

Pronotum light yellow, the propleura blackened. Lateral pretergites yellowish testaceous, becoming narrowed toward the wing-root; tegula light yellow. Mesonotum light reddish brown, with a vague bluish cast, the anterior portion of the præscutum brighter, the posterior præscutum and the scutum narrowly darkened laterally; pseudosutural foveæ pale; setæ of mesonotum short and relatively inconspicuous; scutellum and posterior portion of postnotal mediotergite somewhat brightened. Pleura dark brown ventrally, the dorso-pleural membranes, pteropleurite, and pleuro-tergite remaining light reddish brown. Halteres pale, the extreme base of the stem infuscated, the knobs conspicuously light yellow. Legs with the coxæ and trochanters yellowish testaceous, the fore coxæ darker; of the remaining legs, only a single incomplete posterior leg remains—this obscure yellow, the extreme tip of the tibia infuscated. Wings of the unique type broken.

Abdomen dark brown, the hypopygium more yellowish. Male hypopygium of very unusual structure. Basistyles relatively stout, the ventral lobe produced into a short clavate structure that is provided with microscopic spinulæ and a dense patch of long, powerful, retrorse setæ. The dististyles arise from the base of this lobe; outer style terminating in an oval, densely setuliferous lobe, at the base of which is a powerful, black, sickle-shaped spine. Basal dististyle a long, simple, strongly sinuous rod that terminates in a long, acute, black spine; before the apex of the style, provided with numerous microscopic setulæ. Ædeagus relatively long and stout, a little shorter than the basal dististyle.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, altitude 1000 feet, October 21, 1922 (*A. Tonnoir*).

Molophilus rasilis, sp. n.

Belongs to the *gracilis* group, *ruficollis* subgroup; general coloration shiny reddish brown; wings with a greyish-yellow tinge, the base and costal region more saturated yellow; abdomen dark brown; male hypopygium with the outer dististyle deeply and unequally bifid, the basal dististyle with two long lateral spines, the space between them with long erect setæ.

Male.—Length about 3·8 mm.; wing 4·5 mm.

Rostrum and palpi dark brown. Antennæ relatively short, if bent backwards scarcely attaining the wing-root, dark brown throughout; flagellar segments oval, with conspicuous verticils and a short but dense erect white pubescence. Head dark brown.

Pronotum dark brown. Mesonotum shiny reddish brown, the margins paler; lateral pretergites narrowly yellowish; scutum reddish brown, the caudal margin narrowly yellowish; scutellum brownish testaceous; postnotum shiny brown. Pleura shiny reddish brown. Halteres with the stem pale brown, yellow at base, the knobs obscure brownish yellow, with dark setæ. Legs with the coxæ testaceous yellow; trochanters yellow; femora yellow, the tips narrowly darkened, more extensively so on the fore legs; tibiæ brownish yellow, the fore tibia (♂) darkened but scarcely dilated at base; tarsi dark brown, the basitarsi somewhat paler at base. Wings with a greyish-yellow tinge, the base and costal region more yellowish; veins yellowish brown, with long, pale brown macrotrichiæ. Venation: *r* lying shortly beyond the level of *r–m*; vein *2nd A* moderately elongate, ending about opposite the caudal end of *m–cu*.

Abdomen dark brown, the hypopygium a little more yellowish. Male hypopygium with the ventral lobe of the basistyle produced into a long slender lobe, the mesal face with abundant setulæ and fewer scattered erect setæ that tend to become retrorse at the apex; outer face of the lobe with fewer scattered large setæ; dorso-mesal angle of basistyle produced into a low rounded lobe. Dististyles placed close together in the notch between the lobes of the basistyle; outer dististyle with a short stout stem, the arms slender, especially the outer arm which is more than twice the length of the stem, sinuous, gradually narrowed to the slightly spatulate apex; inner arm much shorter, about equal in length to the stem, gently arcuated. Basal dististyle a powerful blackened rod, terminating in a slender curved spine, with a similar straight spine on the face at about two-thirds the length of the style, the area between these spines with numerous very long erect setæ that are approximately as long as the spines. Ædeagus long and slender, tapering to the slender apex, in balsam mounts extending caudad to nearly opposite mid-length of the ventral lobe of the basistyle.

Hab. Tasmania.

Holotype, ♂, Wilmot, January 8, 1923 (*A. Tonnoir*).

Molophilus verticalis, sp. n.

Belongs to the *verticalis* group; general coloration reddish brown to dark brown, the pronotum and lateral pretergites conspicuously yellow; head yellow, the centre of the vertex grey; halteres yellow; wings yellow, the veins and macrotrichiæ darker; male hypopygium with the dorsal lobe of the basistyle produced caudad into a stout lobe that terminates in a chitinized spine; outer dististyle profoundly bifid, each arm needle-like.

Male.—Length 3·8–4·5 mm.; wing 4·7–6 mm.

Female.—Length 4·5–4·6 mm.; wing 6–6·2 mm.

Rostrum and palpi black. Antennæ of moderate length, if bent backward (♂) extending about to the wing-root; scape and basal segments of flagellum yellow, the organ passing into brown toward outer end; flagellar segments long-oval with an erect white pubescence and unilaterally-arranged verticils. Head ochre, the centre of the vertex largely grey. In the Mt. Field paratype, the head is uniformly grey.

Pronotum yellow, more infuscated laterally. Lateral pretergites light sulphur-yellow, extending caudad to the concolorous tegula. Mesonotal reddish brown to dark brown, with a faint grey cast; pseudosutural foveæ light chestnut-brown, inconspicuous; scutellum yellowish to testaceous; postnotum dark brown, the mediotergite with a yellow spot on either side. Pleura dark reddish brown, in some specimens distinctly pruinose; dorsal portion of the postnotal pleurotergite paler; dorso-pleural membrane more or less yellowish. Halteres yellow. Legs with the fore coxæ brown, the other coxæ and the trochanters yellow; femora obscure yellow, the tips vaguely darkened; tibiæ light brown, the tips narrowly darker, fore tibia (♂) with a very narrow, dark brown, subbasal ring; tarsi passing into dark brown. Wings with a strong yellowish tinge, the veins and macrotrichiæ darker yellow. Venation: *r* lying shortly beyond *r–m*; *m–cu* relatively short and straight, oblique; vein *2nd A* ending opposite the proximal end of the petiole of cell M_3.

Abdomen clothed with conspicuous yellow setæ, the tergites obscure yellow, with an interrupted darker dorsomedian stripe. In a few specimens the abdomen is uniformly brown, the hypopygium usually more reddish brown. Male hypopygium with the basistyles relatively slender, the dorsal portion produced into a stout lobe, the outer lateral angle of which is further produced into a slender, sinuous, chitinized

blade or point, the style at base of this blade a little elevated and with a group of about eight powerful setæ. Mesal face of basistyle with a small lobe that is provided with strong spinous setæ. Outer dististyle profoundly bifid, each arm long and slender, needle-like, the outer arm longer, a little dilated before the acute blackened apex; inner arm more slender, a long, feebly sinuous, acicular black spine. Inner dististyle an elongate blackened rod, a little dilated before the slightly curved spinulose apex; the dilated portion of the style with a small tooth-like or wing-like expansion. Ædeagus long and slender, straight.

Hab. Tasmania.

Holotype, ♂, Fern Tree, Mt. Wellington, November 11, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotype, 1 ♂; *paratypes*, 1 ♂, Burnie, January 31, 1923; 2 ♂♂, St. Patrick's River, October 30–November 4, 1922; 1 ♂, 1 ♀, Cradle Valley, January 10–27, 1923; 1 ♂, Mt. Field, December 19, 1922; 2 ♂♂, National Park, December 16, 1922; 1 ♂, 1 ♀, Eaglehawk Neck, Tasman Peninsula, November 18, 1922; 5 ♂♂, Mt. Wellington, November 21–30, 1922; 1 ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Molophilus verticalis reductus, subsp. n.

In the mountainous section of North-western Tasmania there occurs a large form of *verticalis* that is of great interest. The subspecies varies almost as widely in its general coloration as does the typical form, tending to have the thorax and abdomen more uniformly darker brown. The male hypopygium differs from the typical form in several regards. The dorsal lobe of the basistyle is much more slender and is not produced into a shoulder at the base of the narrowed apical portion, the few long setæ being placed along the mesal edge; the lobe narrows gradually to the very short chitinized apex. Outer dististyle with the outer arm dilated on basal half and here microscopically spinulose, the apical half a long straight slender spine; inner arm stouter and more sinuous. Inner dististyle more slender apically, without the conspicuous wing before the microscopically spinulose apex.

Holotype, ♂, Cradle Valley, January 12, 1923 (*A. Tonnoir*).

Paratopotypes, 3 ♂♂, January 24–27, 1923 (*A. Tonnoir*).

Molophilus furvus, sp. n.

Belongs to the *plagiatus* group; general coloration dark blackish grey; halteres with sulphur-yellow knobs; wings with a strong brownish tinge; vein *2nd A* short; male hypopygium with the basistyles elongate; basal dististyle a slender rod that is bent strongly ventrad at the apex into a blackened spine.

Male.—Length about 2·4 mm.; wing 3·2 mm.

Female.—Length about 2·7 mm.; wing 3·5 mm.

Rostrum and palpi black. Antennæ (♂) with the scape dark brown, the flagellum brownish black; moderately elongate, in ♂ if bent backward extending about to the base of the abdomen; flagellar segments fusiform, with conspicuous verticillate hairs. Head dark grey.

Pronotum dark brown. Mesonotum dark blackish grey, the humeral region of the præscutum vaguely more reddish. Pleura dark grey, the dorso-pleural membrane dark. Halteres pale, the knobs light sulphur-yellow. Legs with the coxæ and trochanters dark brown; remainder of legs brownish black, the femoral bases a little paler. Wings with a strong brownish tinge, the centres of the cells beyond the cord somewhat paler; veins darker brown; macrotrichiæ dark brown. Venation: *r* opposite to just beyond the level of *r–m*; *m–cu* long and gently arcuated; vein *2nd A* short, a trifle longer in the female, in the male ending about one-third its length before the level of the caudal end of *m–cu*.

Abdomen dark brown, including the hypopygium. Male hypopygium with the basistyles very elongate, the apex of each with a stout beak surrounded by numerous setæ. Dististyles rather widely separated at origin; outer style stout, shallowly bifid at apex, the outer arm longer flattened, the tip obliquely truncated; inner arm small. Basal dististyle a very long and slender, chitinized rod, the distal third sinuous and blackened, narrowed to the acute tip; in a position of rest, these styli lie on the dorsal face of the basistyle, directed caudad, the long acute apex ventrad. Ædeagus long, slender, straight. Ovipositor with the basal shields dark, the valves horn-coloured; dorsal valves very slender and acute, gently upcurved; sternal valves a little longer, nearly straight.

Hab. New South Wales.

Holotype, ♂, Mt. Wilson, altitude 3475 feet, November 19, 1921 (*A. Tonnoir*).

Allotopotype, ♀, *in copula* and pinned with type.

Paratopotype, ♂.

XX.—*New Species of African* Meenoplidæ (*Fulgoroidea, Homoptera*). By F. Muir, Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

Dr. E. Bergroth had this small family under revision at the time of his death. Unless he left a finished manuscript his work will be lost to homopterists. This will be a loss, as the few genera placed in this family are closely allied and the species mostly inadequately described.

The group was erected into a family by the writer in 1925, and further study fully justifies this on good morphological grounds. With the Kinnaridæ they are separated from other Fulgorids by the steep tectiform abdomen, the sixth, seventh, and eighth tergites of which are membranous in the middle and, in the female, the two sclerites on each of these tergites bear wax-secreting pores from which long filaments of white waxy secretion project. The texture of these wax-secreting areas differs considerably. In *Anigrus albinervosa* it is divided up into small irregular quadrate spaces, formed by long irregular longitudinal lines and short straight transverse lines; in *Inxwala modesta* the surface is covered with small circles closely packed together, the areas often appearing six-sided. The structure of both male and female genitalia places them away from the Cixiidæ and allied families and with the families allied to the Fulgoridæ, Ricanidæ, etc. The Kinnaridæ are easily separated by the absence of granulation on the claval area and elsewhere on the tegmen, and by their general build.

The genera of Meenoplidæ, so far as the writer knows them, can be separated as follows:—

1 (14). Claval veins forking near apex of clavus; the first claval vein strongly granulate, second not granulate or only slightly. First claval generally curved, second subparallel to hind margin.
2 (3). Frons with a distinct median carina .... *Phaconeura.*
3 (2). Frons without a median carina.
4 (7). No carinæ on clypeus.
5 (6). Tegmen narrow; *M* arising at base of $Sc+R$; *Cu* before fork and the first claval vein only slightly curved.......................... *Nisia.*
6 (5). Tegmen broader; *M* arising more distad; *Cu* before fork and the first claval vein considerably curved .... *Kermesia.*
7 (4). Lateral carinæ of clypeus distinct.
8 (11). No break at clypeal suture between the lateral carinæ of frons and clypeus.
9 (10). Vertex longer than wide .... *Eponisia.*

10 (9). Vertex wider than long .... *Robigalia.*
11 (8). A break at clypeal suture between the lateral carinæ of frons and clypeus.
12 (13). Tegmina comparatively narrow, not greatly broadened at apex; generally seven apical cells. *Suva.*
13 (12). Tegmina broad, greatly broadened at apex, generally eight or nine apical cells .... *Kermesia.*
14 (1). Claval veins forking nearer to middle of clavus; second claval vein granulate. First claval vein generally straight, subparallel to suture, second claval vein curved.
15 (16). Frons and vertex with a distinct median carina, often obscure on base of vertex and apex of frons .... *Inxwala.*
16 (15). Frons without a distinct median carina.
17 (18). Clypeus without lateral carinæ................ *Meenoplus.*
18 (17). Clypeus with lateral carinæ.
19 (20). Vertex without a median longitudinal carina; lateral carinæ of frons and clypeus not interrupted at clypeal suture .... *Anigrus.*
20 (19). Vertex with a fine or swollen median carina; lateral carinæ of frons and clypeus interrupted at clypeal suture......................... *Paranisia.*

This table supplants the one by the writer in 1926 *, but as it is partly based upon literature and not specimens it is likely to be further emended. It has been found impossible to keep *Paranigrus* apart from *Inxwala,* Distant.

The following African species were not found among the material under review:—

Anigrus sordidus, Stål; *Anigrus lugens* (Stål); *Anigrus fuscovenosa,* Jacobi; *Anigrus fuscomaculata,* Mel.; and *Inxwala muiri* (Bergroth).

The types of the species here described as new are in the British Museum.

NISIA, Melichar.

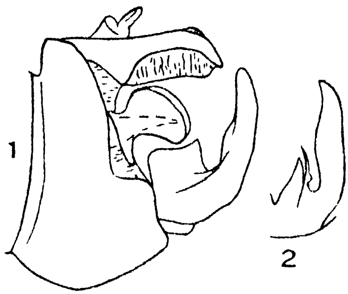
Nisia atrovenosa (Leth.). (Figs. 1, 2.)

One male and one female from Ceres, Cape Province (*R. E. Turner*, iii. 1925); two females from Weenen, Natal (*H. P. Thomasset,* iii.–iv. 1924); one female from Zanzibar (*H. J. Snell,* i.–ii. 1925); and one female from Bomatok, Sierra Leone (*E. Hargreaves,* 22. v. 1925).

The type of this species is from Nias, Sumatra, but the writer has never seen a male from that locality. It has been reported from a number of localities, and the writer

* Pan-Pacific Entom. i. (3) p. 110.

has at least three species under this name. Until a proper revision can be undertaken, he considers it best to allow them all to remain under *atrovenosa*. The male genitalia of



Nisia atrovenosa.

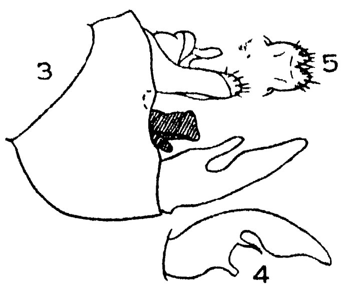
Fig. 1.—Lateral view of male genitalia.
Fig. 2.—Ventral view of right genital style.

the specimen from Ceres is very close to those of specimens from Queensland, but distinct from those of specimens from Taihoku, Formosa.

Nisia albinotata, sp. n. (Figs. 3, 4, 5.)

Male : length 2·5 mm., tegmen 3·3 mm.

The triangular areas at base of vertex small, distinct; sides



Nisia albinotata.

Fig. 3.—Lateral view of male genitalia.
Fig. 4.—Ventral view of left genital style.
Fig. 5.—Dorsal view of apex of anal segment.

of frons subparallel to near apex, carinæ of frons not continued on to the clypeus, no carinæ on clypeus; mesonotum

with one (median) faint carina. Claval veins forking near apex of clavus, first vein curved, considerably granulate, second subparallel to hind margin, not granulate; *Sc+R* thick, slightly granulated; *M* 3+4 and *Cu* 1 touching for some distance; three apical *Ms* (1, 2, and 3).

Sordid stramineous; lateral carinæ of frons and vertex fuscous, mesonotum darker than pronotum, abdomen dark brown with light pleura. Tegmina stramineous, slightly fuscous, darker fuscous over base of *M* and *Cu*, the claval, costal, and subcostal cells; a distinct white spot over apical cross-veins between *R* and *Cu*; a small white mark at node and another at apex of clavus; veins fuscous. Wings hyaline, slightly opaque with waxy secretion, veins light brown. Genitalia figured.

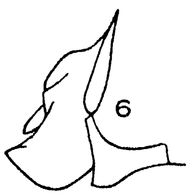
Female similar to male, but slightly darker in colour. The pregenital plate divided longitudinally into two sclerites.

Described from two males and one female from Mossel Bay, Cape Province (*R. E. Turner*, iii. 1922).

Nisia albovenosa, sp. n. (Fig. 6.)

Female: length 2·9 mm., tegmen 3·6 mm.

Triangular areas at base of vertex small, width at base equal to length in middle, lateral carinæ projecting considerably, forming a deep U-shaped emargination at apex;



Nisia albovenosa.

Lateral view of female genitalia.

length of frons more than twice the width (2·5 to 1), sides subparallel till apex, where they curve slightly. No lateral carinæ on clypeus, but the sides are flattened so that there is an angulation which might be construed as a carina. Venation typical, four apical *Ms*, viz., 1, 2 and 3, 4. The genitalia are considerably flattened laterally.

Yellow; lateral carinæ of vertex and frons black along the edges, a few small dots on genæ and the median ocellus

black; middle of pronotum and mesonotum lighter, lateral portions darker; abdominal sclerites dark brown, pleura and intersegmental membrane yellow. Tegmina fuscous, veins white, the middle of some of the cells (i. e., *R* and *M* basal) lighter; the granulations on first claval dark against the white background; wings slightly fuscous, with darker veins.

Described from one female from Port St. John, Pondoland (*R. E. Turner*, iv. 1923).

KERMESIA, Melichar.

So far this genus has only been reported from India, Ceylon, and Java. The African species described below appear to be typical. The first claval vein is curved and recurved and heavily granulate, joining the second near the apex, the second is subparallel to the hind margin and not granulate; the *M* 3 and 4 touches *Cu* 1 for a short distance, the stem of *Cu* is considerably curved, *Sc*+*R* slightly granulate, the tegmen is broad at the apex. The lateral carinæ of frons continue on to the clypeus for a very short distance; the apical two-thirds of clypeus considerably flattened laterally, thus forming a median ridge or carina. No signs of a median carina on vertex or frons.

Kermesia immaculata, sp. n. (Fig. 7.)

Male: length 2·9 mm., tegmen 5 mm.

Light stramineous, abdomen darker, the sixth, seventh, and eighth tergites with lighter hind margins. Tegmina

Kermesia immaculata.
Lateral view of male genitalia.

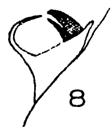
hyaline, opaque with waxy secretion, the veins light stramineous. Wings hyaline, opaque with waxy secretions, veins light stramineous or yellow. The genitalia figured; the

genital style subtriangular, the lower corner prolonged into a large curved spine, the upper corner into a smaller spine curved inward; apex of anal segment truncate or very slightly emarginate.

Female: length 3·8 mm., tegmen 5·6 mm.

In build and colour similar to the male. Pregenital plate small, quadrate, narrower at apex than at base. Anterior styles touching along the middle line, inner margin entire, slightly curved upward, apex on outer margin produced into a small curved process.

Described from four males and two females from Aburi, Gold Coast (*W. H. Patterson*, 1912–1913),



8

Kermesia albipennis.
Lateral view of right genital style.

Kermesia albipennis, sp. n. (Fig. 8.)

Male: length 2·3 mm., tegmen 4 mm.

Stramineous; tegmina hyaline, opaque with white waxy secretion, veins all white. Wings hyaline, opaque with white waxy secretion. The genitalia differ from those of *C. immaculata* in having the genital style narrower, the curved process much thinner and longer. The ædœagus was not dissected out.

Described from one male from Njala, Sierra Leone, taken on African oil-palm (*E. Hargreaves*, 19. iv. 1925).

9

Kermesia albidipennis.
Lateral view of right genital style.

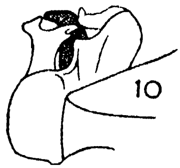
Kermesia albidipennis, sp. n. (Fig. 9.)

Male: length 1·9 mm., tegmen 3·2 mm.

In build and colour this species is similar to *K. albipennis*.

The genitalia are distinct; the genital style and apex of ædœagus are figured for comparison.

Described from one male from Songo, Sierra Leone (*E. Hargreaves*, 13. ix. 1924). A female from Movamba, Sierra Leone (*E. Hargreaves,* 17. vii. 1925, at light), may belong to this species.



Kermesia inornata.
Lateral view of male genitalia.

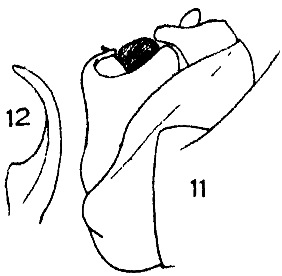
Kermesia inornata, sp. n. (Fig. 10.)

Male : length 2 mm., tegmen 3·6 mm.

Stramineous; the tegmina hyaline, white, slightly opaque with a waxy secretion; veins white. Wings hyaline, slightly opaque with waxy secretion, veins white.

The genital styles separate this species from *K. albidipennis*, as a comparison of the figures will show.

Described from one male from Bomatok, Sierra Leone (*E. Hargreaves*, 22. v. 1925).



Kermesia albinervosa.
Fig. 11.—Lateral view of male genitalia.
Fig. 12.—Ventral view of right genital style.

Kermesia albinervosa, sp. n. (Figs. 11, 12.)

Male: length 1·4 mm., tegmen 2·2 mm.

The two triangular areas at base of vertex obscurely joined

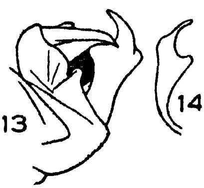
together, making two irregular quadrate areas. Lateral carinæ of clypeus small but distinct, median carina distinct on apical half.

Brown, or sordid stramineous; the lateral carinæ of head lighter; two medio-lateral light marks on pronotum continued on to mesonotum. Tegmina fuscous, with white veins, the white extending into the membrane slightly, making the veins very distinct. Wings slightly fuscous, opaque with waxy secretion, veins slightly darker.

Female: length 2 mm., tegmen 2·7 mm.

Pregenital plate quadrate, about as broad as long, hind margin slightly arcuately emarginate. In build and colour similar to the male. Genitalia figured; the genital styles come nearest to those of *K. albidipennis*, but they can easily be distinguished from that and the other four species figured.

Described from one male and one female from Hill Station, Sierra Leone (*E. Hargreaves*, 6. iii. 1924).



Kermesia hargreavesi.

Fig. 13.—Lateral view of male genitalia.
Fig. 14.—Ventral view of left genital style.

Kermesia hargreavesi, sp. n. (Figs. 13, 14.)

Male: length 2·3 mm., tegmen 3·5 mm.

The two angular areas at base of vertex joined together, forming a short quadrate area not divided in the middle, or only by an obscure mark.

Light yellow or stramineous, slightly darker on mesonotum with a lighter mark down middle. Tegmina hyaline, opaquely white with waxy secretion, the apical and subapical cells each having a light fuscous mark; veins white. Wings hyaline, white with waxy secretion, veins white.

Genitalia figured, but the ædœagus not dissected out; anal segment slightly broadened at apex and slightly emarginate. They are very distinct from any others described above.

Female slightly larger, but otherwise similar to the male.

Described from one male and one female from Bap, Sierra Leone (*E. Hargreaves*, 22. xi. 1924). There is also a damaged male from the same locality taken at the same time.

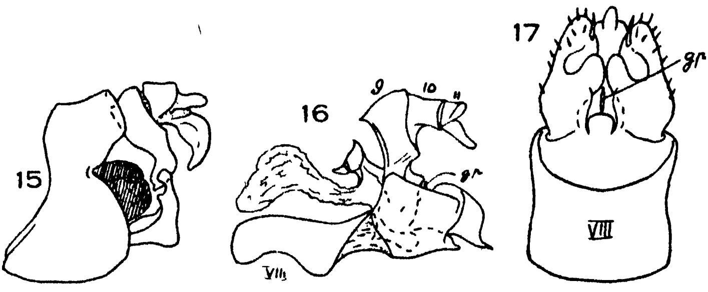
INXWALA, Distant.

Paranigrus, Bergroth, 1920, Ark. Zool. xii. no. 17, p. 18 (n. syn.).

The characters used by Bergroth to separate *Paranigrus* from *Inxwala* do not appear to the writer to be of generic value.

Inxwala modesta, Distant. (Figs. 15, 16, 17.)

Two males and four females from Weenen, Natal, 240 ft. (*H. P. Thomasset*, xii. 1923); two females from Port St. John, Pondoland (*R. E. Turner*, v., vi. 1923). This species



Inxwala modesta.

Fig. 15.—Lateral view of male genitalia.
Fig. 16.—Lateral view of female genitalia.
Fig. 17.—Ventral view of female genitalia.

is also reported from Windhuk, Damaraland, and from Nomtele, Andoni, and Ongandjera, in Ovamboland (*Hesse*, 1925).

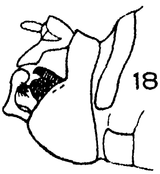
The specimens before the writer agree with Distant's description and also with Hesse's * figures. The male and female genitalia are figured and show the characteristic types of the family. Their affinity with the allied Fulgorid families and their distinctness from the allied Cixiid families is very evident.

* Hesse, Ann. S. African Mus. xxiii, pt. 1, pl. vii. figs. 7, 7 *a*, 7 *b* (1925).

Inxwala bergrothi, sp. n. (Fig. 18.)

Male: length 2 mm., tegmen 3·3 mm.

Brown; head, pronotum, tegulæ, and legs lighter; mesonotum and abdomen darker, abdominal pleura yellow. Tegmina fuscous, veins darker, the node and a mark at apex of clavus light, the two apical cross-veins between *R* and *Ms* light. Wings fuscous with brown veins.



Inxwala bergrothi.
Lateral view of male genitalia.

The median carina of vertex faint on base, that of frons faint distad of middle. The genitalia are figured, but the ædœagus has not been dissected out.

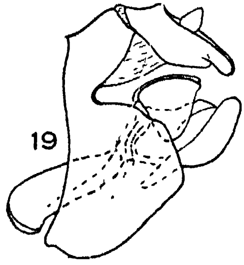
Female: length 2·6 mm., tegmen 3·8 mm.

In build and colour similar to male.

One male and one female from Njala, Sierra Leone, on African oil-palm (*E. Hargreaves*, 23. i. 1925); two males and three females from Njala (*E. Hargreaves*, 21, 23. v. 1926), and one female from Sierra Leone (*E. Hargreaves*, 1925). There are two females from Port St. John, Pondoland (*R. E. Turner*, iv. 1923 and ix. 1921), in which the head and pronotum are piceous. They are best placed in this species until males are discovered.

Anigrus stramineus, sp. n. (Fig. 19.)

Male: length 2·3 mm., tegmen 3·8 mm.



Anigrus stramineus.
Lateral view of male genitalia.

The fork of the claval veins is about one-third from apex, but the straight first claval, parallel to the suture, and the heavily granulated and curved second claval indicate to which group this belongs. The tegmen is but slightly constricted at apex of clavus. Median carina of clypeus distinct. Mesonotum with only one median carina.

Stramineous; mesonotum darker, abdomen dark brown. Tegmina hyaline, slightly stramineous ; veins stramineous ; apical margin slightly fuscous. Wings hyaline, very slightly fuscous, veins light fuscous. Wings and tegmina, as well as body, fairly thickly covered with white, waxy, powdery secretion.

The pygofer distinctly constricted near middle, with the membrane between distinctly chitinized, thus making two divisions, one from which the anal segment arises and the other from which the ædœagus and genital styles arise. Genital styles thin, fairly narrow, curved from base to the rounded apex. The anal segment is produced into two rounded processes at apex.

Female : length 2·7 mm., tegmen 3·8 mm.

In build and colour similar to male. The ovipositor not dissected out; the pregenital segment short, broader than long.

Described from three males and one female from Freetown, Tinana, Njala, and Blama, Sierra Leone (*E. Hargreaves*, vii., viii. 1924 ; i., vi. 1925), one taken on African oil-palm.

Anigrus turneri, sp. n.

Female : length 3·4 mm., tegmen 4·5 mm.

The vertex (all of head seen in dorsal view) longer than wide, two small angular areas at base, apex wider than base, the middle of frons bulging out. Frons gradually widening from base to near apex, then slightly narrowing, sides arcuate ; lateral carinæ large, continuing on to the sides of clypeus without a break ; median carina on clypeus faint at base, distinct apically ; no trace of median carina on frons or vertex. A median carina on mesonotum, no lateral carinæ. Claval veins forking a little distad of middle, first claval parallel to suture, thick, with a few granules ; second curved, thick, heavily set with granules ; *Sc*+*R* thick, very slightly granulate ; *M* arising from *Sc*+*R* at some distance from base ; *M* near fork touching *Cu* 1 ; four *Ms* present (1, 2, 3, and 4).

Stramineous ; sides of clypeus, genæ below eyes and above ocelli darker stramineous ; mesonotum darker, with a

light line down middle; abdomen dark brown, with yellow or light pleura. Tegmina sordid stramineous, more fuscous over apical cells; veins light, except the apical veins which are fuscous. Wings fuscous with dark veins.

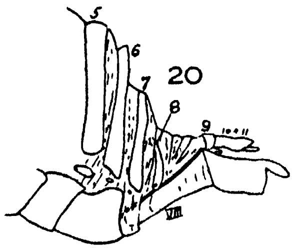
Pregenital plate subquadrate, apex slightly wider than base, posterior margin slightly sinuous.

Described from two females from Port St. John, Pondoland (*R. E. Turner*, vi. 1923).

Anigrus albinervosus, sp. n. (Fig. 20.)

Female: length 1·7 mm., tegmen 3 mm.

No sign of a median carina or vertex on frons; the frontal and clypeal lateral carinæ not interrupted at clypeal suture. Second claval vein heavily granulate, first claval and *Sc*+*R* very slightly so, first claval curved before the fork; one median carina on mesonotum. *Sc* touching *R* for a short distance, thus forming a diamond-shaped cell at forking of *Sc* and *R*; *M* 3 and 4 touching *Cu* for a short distance.



Anigrus albinervosus.
Lateral view of apex of female abdomen.

Dark, shiny brown; the labium, median carina of clypeus, lateral carinæ of frons, margins of pronotum, margins of tegulæ, median carina of mesonotum, tibiæ and apices of femora much lighter. Tegmina light fuscous, with some small, irregular hyaline spots, four in costal cells, one in *R* cell, irregular in clavus, and in the middle of the apex of each apical cell; the veins of *Sc*+*R*, *M*, *Cu*, claval and cross-veins and apical cross-veins white; the apical veins dark fuscous, spreading into cells. Wings fuscous, with dark fuscous veins.

The pregenital plate (sternites vii. and viii., or viii. only) exceedingly long, the basal third fairly well chitinized, the apical two-thirds membranous; the lateral margins strongly chitinized, and appearing as chitin rods.

One female specimen from Shenge, Sierra Leone, at light (*E. Hargreaves*, 1. v. 1925).

XXI.—*The Localities whence the Foraminifera figured in the Report of H.M.S. 'Challenger' by Brady were derived.* By W. L. F. Nuttall, D.F.C., M.A., Ph.D., The Sedgwick Museum, Cambridge.

Introduction.

Brady's Monograph on the Foraminifera † has long been recognized as the most important standard work on the subject. It contains over 2000 excellent figures of specimens collected from all over the world. It is a serious omission that, except in the case of a few of the rarer forms, Brady failed to give the localities of the figured specimens. In the course of a study of the group I have had occasion to examine Brady's type-material, and have compiled a list of the localities of all the figured specimens that I have been able to find.

It is well known that Brady held a fairly wide interpretation of the species of Foraminifera he described. This is not in agreement with the views held by certain recent workers—notably Dr. J. A. Cushman in America—who have adopted a more restricted definition of a species. With the rapidly increasing knowledge of the group, a revision has not infrequently been found necessary. In a number of cases, although the original material was not examined, new names have been proposed for specimens figured by Brady. In a revision of this type it is of utmost importance that the locality of Brady's figured specimens should be known, so that these figures may be compared with material in other collections from the same region. If the list given is read in conjunction with Brady's work, I feel confident that it will be of assistance to those studying the Foraminifera.

A greater part of the Brady Collection is deposited in the Zoological Museum at Cambridge, whereto Mr. Forster Cooper has kindly given me access. Of the figured specimens about one-half are in the Zoological Department of the British Mnseum (Natural History). I wish to thank Mr. R. Kirkpatrick for giving me every facility to examine this collection. I am indebted to Mr. A. G. Brighton for assistance in checking the manuscript.

† Brady, H. B., 1884, "Report on the Scientific Results of the Voyage of H.M.S. 'Challenger,'" vol. ix., Zoology, pp. 1–814, 115 plates in separate volume.

Explanation.

The Localities of the Figured Specimens.—The material described in the Monograph was mostly collected during the cruises of H.M.S 'Challenger,' but Brady examined other collections, including those made by the ships 'Porcupine,' 'Knight Errant,' 'Valorous,' etc. On pages 79 to 127 of the Report (see also maps at end) is found a list of the stations from which collections were made, with details as to exact locality, longitude, and latitude, as well as depth in fathoms. The only data given in the list below are station-numbers and short locality-names. Where the station-number is not followed by the name of a ship (such as Pl. I. fig. 1, Sta. 24), the word 'Challenger' should always be added. In the case of stations of other ships the name of the ship is stated. When no station-number is mentioned (as Pl. I. figs. 9–15), the source of the collection is usually not given on the label attached to the specimen. In a few such instances the collector is mentioned on the slide, but names of these individuals have been omitted in the list, the locality given being as complete as possible.

The Collections in which the Specimens are deposited.—As previously stated, the figured specimens are partly in Cambridge and partly in London. In the list (*vide* Pl. I. figs. 1–4) at the end of some occurrences is a number in brackets such as (2), which refers to the number in the British Museum Catalogue. It will be noted that this number only refers to figs. 2–4, whereas fig. 1 is without a number after the locality. All figures not followed by a bracketed number are of specimens at Cambridge. The specimens in London are catalogued in the Zoological Department of the British Museum (Nat. Hist.) and the catalogue-numbers have been abreviated as follows:—

(*a*) Where the bracketed numbers are single, such as (2), (10), or (500), this number should be preceded by 85. 10. 5, the complete catalogue-number of (2) being therefore (85. 10. 5. 2). The first numbers refer to the date 5th October, 1885.

(*b*) In other cases, such as Pl. II. figs. 7, 8, the number given is (9. 29. 1), or in Pl. V. fig. 6 it is (10. 3. 10); in these and subsequent similar cases the year 85 has been omitted, the complete catalogue-number being (84. 9. 29. 1) or (85. 10. 3. 10).

(*c*) In the collection more than one figured specimen is sometimes mounted on a single slide, so that the same catalogue-number may apply to two figured specimens.

Abbreviations, etc.—The following abbreviations are employed :—f. or fig. = figure, Sta. = Station, N. = North, S. = South, E. = East, W. = West. The generic and specific nomenclature is that given in the Monograph. Reference is omitted to any figures the specimens of which I have been unable to find. The written labels on Brady's slides are not always clear, and in the list doubtful data are questioned. Very occasionally two slides have labels bearing a single figured specimen. In such cases the figured specimen has usually been identified by comparison with the actual figure, and is shown in the list by an asterisk after the number of the figure. The recognition is, however, not always possible, since as many as twenty or more specimens of one species (one of which is figured) may be found mounted on a single slide.

Pl. I.

f. 1–4. *Nubecularia tibia* J. & P.; fig. 1, Sta. 24, West Indies. figs. 2–4, Sta. 217 A, Papua (2).
f. 5–8. *N. inflata* Brady, Sta. 260 A, Honolulu (1).
f. 9 15. *N. lucifuga* Defr., Gulf of Bombah, Tripoli (dredged), figs. 13–15 (10. 13. 118).
f. 17, 18. *Biloculina irregularis* d'Orb.; fig. 17, Sta. 23, West Indies (4). fig. 18, Sta. 85, Canary Islands.
f. 19, 20. Biloculine variety of *Triloculina cuneata* (Karrer), off Tripoli.

Pl. II.

f. 1, 2. *Planispirina sigmoidea* Brady, Sta. 120, off Pernambuco (81).
f. 4. *Biloculina sphæra* d'Orb., Sta. 246, N. Pacific (5).
f. 5, 6. *B. bulloides* d'Orb.; fig. 5, Sta. 76, Azores (15). fig. 6, Sta. 36, 'Porcupine,' off Ireland.
f. 7, 8. *B. ringens* (Lam.); fig. 7, Sta. 24, West Indies (6). fig. 8, Sta. 78, N. Atlantic (9. 29. 1).
f. 9. *B. elongata* d'Orb., Sta. 24, West Indies (8).
f. 10, 11. *B. depressa* d'Orb. var. *murrhyana* Schwager; fig. 10, Sta. 224, N. Pacific. fig. 11, Sta. 323, S. Atlantic (12).
f. 12. *B. depressa* d'Orb., Sta. 352 A, Cape Verde Islands (10).
f. 13, 14. *B. lævis* (Defr.); fig. 13, Sta. 28, 'Porcupine,' N.W. of Ireland. fig. 14, Sta. 24, West Indies (13).
f. 15–17. *B. depressa* d'Orb.; fig. 15, Sta. 323, S. Atlantic (9). fig. 16, Sta. 23, 'Porcupine,' N.W. of Ireland. fig. 17, no locality.

Pl. III.

f. 1, 2. *Biloculina depressa* d'Orb., St. AA, 'Porcupine,' Skye.
f. 3. *B. depressa* d'Orb. var. *serrata* Brady, Sta. 168, New Zealand (11).
f. 4, 5. *B. ringens* var. *denticulata* Brady; fig. 4 *a*, Sta. 172, Friendly Islands. figs. 4 *b*, 5; Sta. 260 A, Honolulu (17).
f. 6. *B. tubulosa* Costa, Sta. 174 C, Fiji (14).
f. 7, 8. *B. ringens* var. *striolata* Brady; fig. 7, St. 187 A, Torres Strait (18). fig. 8, Str. 187, S. of Papua.
f. 9. *B. comata* Brady, Sta. 24, West Indies (7).

f. 10–12. Young Miliolinæ, probably the early stage of *Miliolina pulchella* (d'Orb.); fig. 10, Sta. 205 A, Hong Kong (65). figs. 11, 12; Sta. 217 A, Papua.
f. 14–16. *Miliolina trigonula* (Lam.); fig. 14, Sta. 76, Azores (44). fig. 15 *a*, Sta. 23, 'Porcupine,' N.W. of Ireland. fig. 15 *b*, Sta. AA, 'Porcupine,' Skye. fig. 16, no locality.
f. 17. *M. tricarinata* (d'Orb.), Shell Cove, Port Jackson (10.3.105).

Pl. IV.

f. 1, 2. *Miliolina bucculenta* var. *placentiformis* Brady; fig. 1, Sta. 24, West Indies (53). fig. 2, Sta. 149 D, Kerguelen Islands.
f. 3. *M. circularis* (Born.), Sta. 145, Prince Edward Island (50).
f. 4, 5. *M. valvularis* (Reuss); fig. 4, Sta. 168, New Zealand (38). fig. 5, no locality.
f. 6. *M. transversestriata* Brady, Sta. 185, Torres Strait (59).
f. 7. *M. circularis* var. *sublineata* (Brady), Sta. 218 A, Admiralty Islands (51).
f. 8. *M. insignis* Brady, Sta. 24, West Indies (45).
f. 9. *M. fichteliana* (d'Orb.), Sta. 233 B, Japan (49).
f. 10 *b*. *M. insignis* Brady, Sta. 162, Bass Strait.

Pl. V.

f. 1, 2. *Miliolina cultrata* Brady, Sta. 217 A, Papua (37).
f. 3. *M. gracilis* (d'Orb.), Sta. 217 A, Papua (36).
f. 4. *M. oblonga* (Mont.), Sta. 174 B, Fiji (35).
f. 5. *M. venusta* (Karrer), Sta. 142 A, South Africa.
f. 6. *M. seminulum* (Linné); fig. 6 *a*, Sta. AA, 'Porcupine,' Syke. figs. 6 *b–c*, Sta. 23, 'Porcupine,' W. of Ireland (10. 3. 10).
f. 7. *M. venusta* (Karrer), Sta. 346, S. Atlantic (39).
f. 8, 9. *M. auberiana* (d'Orb.), Sta. 24, West Indies; fig. 8 (40).
f. 10, 11. *M. subrotunda* (Mont.), Sta. 162, Bass Strait (49).
f. 12. *M. cuvierana* (d'Orb.), Sta. 233 B, Japan (41).
f. 13, 14. *M. circularis* (Born.) (?), Sta. 135, St. Atlantic.
f. 15. *Miliolina* sp., Sta. 246, N. Pacific (66).

Pl. VI.

f. 1, 2. *Miliolina secans* (d'Orb.), Sta. 187 A, Booby Island (46).
f. 3–5. *M. labiosa* (d'Orb.); figs. 3, 5; Sta. 135, off Tristan d'Acunha (52). fig. 4, Sta. 306, W. of Patagonia.
f. 6–8. *M. undosa* (Karrer); figs. 6, 7; Sta. 162, Bass Strait (58). fig. 8, Sta. 260 A, Sandwich Islands.
f. 9. *M. bicornis* (W. & J.), Sta. AA, 'Porcupine,' Skye (10. 3. 123).
f. 10. *M. amygdaloides* Brady, Sta. 232, S. of Japan (43).
f. 11, 12. *M. bicornis* (W. & J.), Sta. AA, 'Porcupine,' Skye.
f. 13. *M. pulchella* (d'Orb.), W. coast of Scotland (10. 3. 107).
f. 15–17, 19, 20. *M. linnæana* (d'Orb.); figs. 15, 17, 19, 20; Sta. 260 A, Honolulu (55). fig. 16, Sta. 218 A, Admiralty Islands.

Pl. VII.

f 1–4. *Miliolina separans* Brady; fig. 1, Sta. 185, Torres Strait (56). figs. 2, 3; Storm Bay, Tasmania, fig. 2 (10. 3. 106). fig. 4; Sta. 187 A, Torres Strait.
f. 5, 6. *M. macilenta* Brady, Sta. 219 A, Admiralty Islands (47).
f. 7–12. *M. rupertiana* Brady; figs. 7, 11; Sta. 187, S. of New Guinea, fig. 7 (60). fig. 8, Sta. 186, Torres Strait. fig. 9, Sta. 188, S. of Papua? fig. 10, Sta. 187 A, Torres Strait. fig. 12, Sta. 189, S. of Papua.

f. 13. *Miliolina boueana* (d'Orb.), Sta. 204 A, Manilla (54).
f. 14. *M. parkeri* Brady, Sta. 260 A, Honolulu (59).
f. 15-22. *Haueriria ornatissima* (Karrer); figs. 15, 16, 17, 21; Sta. 218 A, Admiralty Islands, fig. 15 (77), fig. 21 (78). figs. 18, 19; Levuka, Ovalau, Fiji, 12 fathoms. fig. 20, Sta. 174 C, Fiji. fig. 22, Sta. 172, Friendly Islands (79).

Pl. VIII.

f. 1-4. *Planispirina celata* (Costa); figs. 1, 2; Sta. 23, 'Porcupine,' W. of Ireland (10. 3. 11). fig. 3, Sta. 120, off Pernambuco. fig. 4, Sta. 37, 'Porcupine,' off Ireland.
f. 5. *Miliolina crassatina* Brady, Sta. 162, Bass Strait (62).
f. 6, 7. *M. agglutinans* (d'Orb.); fig. 6, Sta. 218 A, Admiralty Islands (61). fig. 7, Sta. 37, 'Porcupine,' off Ireland.
f. 8-10. *M. triquetra* Brady, Sta. 162, Bass Strait; figs. 8, 9; (64).
f. 11. *Spiroloculina asperula* Karrer (?), Sta. 47, 'Porcupine,' Faroe Channel (10. 3. 27).
f. 12. *S. arenaria* Brady, Sta. 174 C, Fiji (24).
f. 13, 14. *S. asperula* Karrer; fig. 13, Sta. 218 A, Admiralty Islands. fig. 14, Sta. 217 A, Papua.
f. 15-20. *Miliolina alveoliniformis* Brady; figs. 15, 16; Sta. 218 A, Admiralty Islands. fig. 15 (63). fig. 17, Sta. 260 A, Sandwich Islands. figs. 18-20; Tongatabu, 18 feet.

Pl. IX.

f. 1. *Miliolina* sp., Sta. 174 A, Fiji (67).
f. 2-4. *M. reticulata* (d'Orb.); figs. 2, 3; Sta. 188, S. of New Guinea (9. 29. 3). fig. 4, Sta. 24, West Indies.
f. 5, 6. *Spiroloculina excavata* Brady, Sta. 218 A, Admiralty Island (22).
f. 7, 8. *S. robusta* Brady, Sta. 24, West Indies (21).
f. 9, 10. *S. nitida* d'Orb.; fig. 9, Sta. 233 B, Japan (19). fig. 10, Sta. 187 A, Torres Strait.
f. 11. *S. planulata* (Lam.), St. AA, 'Porcupine,' Skye (10. 3. 26).
f. 12-14. *S. fragilissima* Brady; figs. 12, 13; Sta. 279 C, Tahiti. fig. 14, Sta. 218 A, Admiralty Islands (20).
f. 15-17. *S. limbata* d'Orb.; fig. 15, Sta. 344, Ascension Island (9. 29. 2). fig. 16, no locality. fig. 17, Sta. AA, 'Porcupine,' Skye.

Pl. X.

f. 1. *Spiroloculina limbata* d'Orb., Sta. 189, S. of Papua.
f. 3, 4. *S. impressa* Terquem, Sta. 217 A, Papua (23).
f. 5, 6. *S. tenuiseptata* Brady; fig. 5, Sta. 191 A, Ki Islands (25). fig. 6, Sta. 174 B, Fiji Islands.
f. 7-11. *S. tenuis* (Czjzek); figs. 7, 8, 11; Sta. 302, S. Pacific (34). figs. 9, 10; Sta. 332, S. Atlantic (33).
f. 12, 13. *S. acutimargo* Brady; fig. 12, Sta. 185, Torres Strait (27). fig. 13, Sta. 120, off Pernambuco (26).
f. 16, 17. *S. grata* Terquem; fig. 16, Sta. 172, Friendly Islands. fig. 17, Sta. 218 A, Admiralty Islands (28).
f. 18-20. *S.* (?) *convexiuscula* Brady, Sta. 185, Torres Strait (30).
f. 21. *S. antillarum* d'Orb., Sta. 122, S.E. of Pernambuco (29).
f. 22, 23. *S. grata* Terquem; fig. 22, Shell Cove, Port Jackson. fig. 23, Sta. 187 A, Booby Island (32).
f. 24-26. *S. crenata* Karrer; fig. 24, Sta. 218 A, Admiralty Islands (31). figs. 25, 26; Sta. 260 A, Sandwich Islands.

Pl. XI.

f. 1–3. *Cornuspira involvens* Reuss; fig. 1 *a*, Sta. 24, West Indies (82). fig. 1 *b*, Sta. 23, West Indies. fig. 2, Sta. 279 c, Tahiti. fig. 3, Sta. 149 D, Kerguelen Island.
f. 4. *C. carinata* (Costa), Sta. 11, 'Porcupine,' W. of Ireland.
f. 5–9. *C. foliacea* (Phil.); figs. 5, 6, 8, 9; Sta. 24, West Indies, figs. 5, 6; (9. 29. 8). fig. 7, Sta. 174 c, Fiji.
f. 10, 11. *Planispirina contraria* (d'Orb.); fig. 10 *a*, St. AA, 'Porcupine,' Skye (10. 3. 8). figs. 10 *b*, 11; Hebrides (70–100 fathoms ?).
f. 12, 13. *Hauerina compressa* d'Orb.; fig. 12, Sta. 187 A, Torres Strait. fig. 13, Sta. 187, Booby Island (76).
f. 14, 15. *H. circinata* Brady, Sta. 187 A, Booby Island (9. 29. 7).

Pl. XII.

f. 1–4. *Planispirina exigua* Brady; figs. 1, 2, 4; Sta. 187 A, Booby Island; figs. 1, 2 (80). fig. 3, Sta. 185, Torres Strait.
f. 5, 7, 8. *Ophthalmidium inconstans* Brady; fig. 5, Sta. 120, off Pernambuco. figs. 7, 8; Sta. 24, West Indies (9. 29. 6).
f. 6. *O. tumidulum* Brady, Sta. 24, West Indies (9. 29. 6).
f. 9–11. *Vertebralina insignis* Brady, Sta. 172, Friendly Islands. fig. 11 (9. 29. 5).
f. 12, 13. *Articulina sulcata* Reuss, Sta. 260 A, Honolulu (68).
f. 14–16. *Vertebralina striata* d'Orb.; fig. 14, Sta. 187, S. of New Guinea (74). figs. 15, 16; Sta. 187 A, Torres Strait.
f. 17, 18. *Articulina conico-articulata* (Batsch), Sta. 24, West Indies (70).
f. 19–21. *A. lineata* Brady, Sta. 33, off Bermudas (69).
f. 22–24. *A. sagra* d'Orb.; fig. 22, Sta. 172, Friendly Islands. figs. 23, 24; Sta. 260 A, Honolulu (9. 29. 4).

Pl. XIII.

f. 1. *Articulina conico-articulata* (Batsch), Sta. 33, Bermudas.
f. 2. *A.* sp., Sta. 279 A, Tahiti (73).
f. 3–5. *A. funalis* var. *inornata* Brady, Sta. 149 D, Kerguelen Islands (72).
f. 6–11. *A. funalis* Brady; figs. 6, 7, 9, 11; Sta. 145, Prince Edward Island. figs. 6, 7 (71). figs. 8, 10; Sta. 149 D, Kerguelen Islands.
f. 12, 13. *Peneroplis pertusus* var. *lævigatus* Karrer, Sta. 33, Bermudas (92).
f. 14. *P. pertusus* var. *carinatus* (d'Orb.), Sta. 352 A, Cape Verde Islands (91).
f. 15 *a*, *b*. *P. pertusus* var. *planatus* (F. & M.), Sta. 218 A, Admiralty Islands (87).
f. 16 *a*, *b*. *P. pertusus* (Forks.), Sta. 185 A, Torres Strait (86).
f. 17, 19. *P. pertusus* var. *arietinus* (Batsch); figs. 17, 19 *b*; Sta. 218 A, Admiralty Islands (9. 29 9). fig. 19 *a* (88).
f. 18. *P. pertusus* var. *arietinus* (Batsch) (?), St. 218 A, Admiralty Islands (9. 29. 9).
f. 20, 21. *P. pertusus* var. *cylindracea* (Lam.), Sta. 173 A, Fiji (89).
f. 22. *P. pertusus* var. *arietinus* (Batsch), Ægean.
f. 24, 25. *P. pertusus* var. *lituus* (Gmelin) (?), Sta. 352 A, Cape Verde Islands (90).

Pl. XIV.

f. 1-12. *Orbiculina adunca* (F. & M.); figs. 1, 4, 5, 10, 11; Coral Sand, Bermuda. figs. 2, 3, 7; Sta. 24, West Indies, figs. 1, 2 (93); figs. 3, 7 (9. 29 10). fig. 6, Sta. 122, off Pernambuco. figs. 8, 9; Sta. 352 A, Cape Verde Islands; fig. 9 (95).

Pl. XV.

f. 1-5. *Orbitolites marginalis* (Lam.); figs. 1-3, Sta. 260, Honolulu (97). fig. 4, Sta. 33, off Bermudas. fig. 5, Sta. 173 A, Fiji (12. 5. 96).

f. 6, 7. *O. tenuissima* Carp., fig. 6 *b*, Sta. 24, 'Porcupine,' N.W. of Ireland. figs. 6 *c*, 7; Sta. 44 [? 'Challenger,'].

Pl. XVI.

f. 1-4, 6. *Orbitolites complanata* (Lam.); figs. 1, 4; Sta. 260 A, Honolulu. figs. 2, 3; Loo Choo Islands. fig. 6, Sta. 172, Friendly Islands.

f. 7. *O. duplex* Carp., Sta. 173 A, Fiji (99).

f. 8-11. *O. complanata* var. *laciniata* Brady; figs. 8-10, Sta. 172, Friendly Islands. fig. 11, Sta. 172 A ?, Tongatabu Reef.

Pl. XVII.

f. 1-6. *Orbitolites complanata* (Lam.), Gulf of Suez, 15-20 fathoms.

f. 9 12. *Alveolina boscii* (Defr.). figs. 9, 10; Sta. 218 A, Admiralty Islands (9. 25. 11). figs. 11, 12; Admiralty Islands, 16 fathoms.

f. 14, 15. *A. melo* (F. & M.), fig. 14, Coral Sand, Bermuda and off Ascension. fig. 15, off Ascension.

Pl. XVIII.

f. 1-8. *Psammosphæra fusca* Schulze; fig. 1, Sta. 16, 'Porcupine,' W. of Ireland. figs. 2, 3; Sta. 286; S. Pacific. figs. 4, 7; Sta. 122, S.E. of Pernambuco. figs. 5, 8; Sta. 323, S. Atlantic. fig. 6, Sta. 23, West Indies (110).

f. 9, 10. *Sorosphæra confusa* Brady; fig. 9, Sta. 23. 'Porcupine,' N.W. of Ireland. fig. 10, Sta. 76, Azores (9. 29. 17).

f. 11, 13, 15-17. *Saccammina sphærica* M. Sars; figs. 11, 13; N. Atlantic, deep water (10. 3. 116). fig. 15, Hardanger Fiord, Norway, 400-500 fathoms. fig. 16, Sta. 23, 'Porcupine,' N.W. of Ireland. fig. 17, Sta. 149 D, Kerguelen Islands.

f. 19. *S. socialis* Brady, Sta. 246, N. Pacific (111).

Pl. XIX.

f. 1-4. *Astrorhiza limicola* Sandahl; figs. 1, 3, 4, Coast of Norway (dredged). fig. 2, off Berry Head, Torquay (10. 3. 117).

f. 6, 8-10. *A. arenaria* Norman; fig. 6, Sta. 64, 'Porcupine,' Faröe Channel. (10. 3. 24). figs. 8-10, Sta. 47, 'Porcupine,' Faröe Channel.

Pl. XX.

f. 3, 5, 9. *Astrorhiza crassatina* Brady, Sta. 64, 'Porcupine,' Faröe Channel.

f. 10-13. *A. angulosa* Brady, Sta. 78, E. of Azores (105).

f. 14-22. *A. granulosa* Brady, Sta. 78, S.E. of Azores, fig. 18 (104).

Pl. XXI.

f. 1, 4, 7–13. *Rhabdammina abyssorum* M. Sars; fig. 1, Sta. 78, E. of Azores (119). fig. 4, Sta. 195, Banda Sea (9.29.20). fig. 7, Sta. 195, Banda Sea (120). figs. 8–12, Sta. 218, N. of Papua. fig. 13, Sta. 23, 'Porcupine,' N.W. of Ireland.

Pl. XXII.

f. 1–6. *Rhabdammina linearis* Brady; figs. 1–3, 5, 6; Sta. 323, S. Atlantic, fig. 1(122). fig. 4, Sta. 16, 'Porcupine,' W. of Ireland.

f. 8.–10. *R. discreta* Brady; fig. 8, Sta. 4, 'Porcupine,' N. Atlantic. fig. 9, Sta. 23, 'Porcupine,' N.W. of Ireland. fig. 10, Sta. 5, 'Valorous,' off Sydney (10. 3. 120).

f. 11–13. *R. cornuta* Brady; figs. 11, 12; Sta. 122, S.E. of Pernambuco. fig. 11 (123). fig. 13, Sta. 28, 'Porcupine,' N.W. of Ireland.

f. 14, 16–18. *Jaculella acuta* Brady, Sta. 122, S.E. of Pernambuco; fig. 17 (9. 29. 18).

f. 19–22. *J. obtusa* Brady, Sta. 7, 'Knight Errant,' Faröe Channel.

Pl. XXIII.

f. 1–3. *Hyperammina friabilis* Brady; fig. 1, Sta. 122, S.E. of Pernambuco (9. 29. 19). fig. 2, Sta. 47, 'Porcupine,' Faröe Channel. fig. 3, Sta, 195, Banda Sea (113).

f. 4. *H. elongata* Brady, off Cumbrae, 60–65 fathoms.

f. 6. *H. friabilis* Brady, Sta. 47, 'Porcupine,' Faröe Channel.

f. 7–10. *H. elongata* Brady; figs. 7, 9, 10; Sta. 323, S. Atlantic (London, no number). fig. 8, Sta. 24, West Indies (112).

f. 15–19. *H. ramosa* Brady; figs. 15, 17–19; Sta. 23, 'Porcupine,' N.W. of Ireland. fig. 16*, Sta. 246, N. Pacific (116).

Pl. XXIV.

f. 1–9. *Hyperammina vagans* Brady; figs. 1, 2; Sta. 120, off Pernambuco (114), figs. 3–6, Sta. 23, 'Porcupine,' N.W. of Ireland, fig. 3 (10. 3. 33). figs. 7–9, Sta. 244, N. Pacific (115).

f. 10–19. *Marsipella elongata* Norman; figs. 10, 11; Sta. 47, 'Porcupine,' Faröe Channel, fig. 11 (10. 3. 2). figs. 12–14, Sta. 23, 'Porcupine,' N.W. of Ireland. figs. 15–17, Sta. 122, S.E. of Pernambuco. figs. 18–19, Sta. 24, 'Porcupine,' off Ireland.

f. 20–22. *H. cylindrica* Brady, Sta. 7, 'Knight Errant,' Faröe Channel.

Pl. XXV.

f. 1–3, 5, 6. *Pilulina jeffreysii* Carpenter; figs. 1 *b*, 2, 3; Sta. 28, 'Porcupine,' N.W. of Ireland (86. 1. 16. 40). figs. 1 *a*, 5, 6; 'Porcupine,' W. of Ireland.

f. 7. *Technitella melo* Norman, Sta. 344, Ascension Island (109).

f. 8, 10–12. *T. legumen* Norman; figs. 8, 12; Sta. 276, S. Pacific (107). fig. 10, Sta. 149 I, Kerguelen Islands (9. 29. 14). fig. 11, off Cumbrae, 60 fathoms.

f. 13, 14. *T. raphanus* Brady, Sta. 174 C, Fiji (108).

f. 15–17. *Storthosphæra albida* Schulze; figs. 15, 17; Kors Fiord, Norway. fig. 16, Bukenfiord, Norway, 365 fathoms.

f. 18, 20. *Pelosina rotundata* Brady, Sta. 23, 'Porcupine,' N.W. of Ireland (10. 3. 25).

Pl. XXVI.

f. 1–6. *Pelosina cylindrica* Brady; figs. 1, 4–6; Sta. 246, N. Pacific. figs. 2, 3; Sta. VIII., Canaries.

f. 7–9. *P. variabilis* Brady, Sta. 168, N.E. coast of New Zealand (9. 29. 12).

f. 10–12. *Hippocrepina indivisa* Parker, Gaspé Bay, mouth of St. Lawrence, 16 fathoms.

f. 17–20. *Bathysiphon filiformis* M. Sars; fig. 17, coast of Norway. figs. 18–20, Hardanger Fiord, Norway.

Pl. XXVII.

f. 1, 2, 4–11. *Aschemonella catenata* (Norman); figs. 1, 2, 4, 5, 7; Sta. 244, N. Pacific, figs. 1, 5, 7 (9. 29. 21). figs. 6, 8–10; Sta. 323, S. Atlantic, figs. 6, 10 (125). fig. 11, Sta. 28 ?, 'Challenger,' N. Atlantic.

f. 12–15. *A. ramuliformis* Brady, Sta. 244, N. Pacific, fig. 12 (127).

Pl. XXVII A.

f. 1–3. *Aschemonella catenata* (Norman), Sta. 244, N. Pacific.

f. 5. *Haliphysema tumanowiczii* Bow, coast of Devon, England.

Pl. XXVIII.

f. 1, 2, 6, 8, 9, 11. *Rhizammina algæformis* Brady; figs. 1, 2, 6; Sta. 299, S. Pacific, fig. 2 (86. 7. 5. 1). figs. 8, 9, 11; no locality.

f. 14, 15. *Sagenella frondescens* Brady; Sta. 218 A, Admiralty Islands, fig. 15 (9. 29. 22).

Pl. XXIX.

f. 1–3. Rhizopod tubes, Sta. 299, S. Pacific.

f. 8–18. *Botellina labyrinthica* Brady, Sta. 51, 'Porcupine,' Faröe Channel, fig. 11 (10. 3. 1).

Pl. XXX.

f. 1–5. *Reophax difflugiformis* Brady; figs. 1–3, Sta. 323, S. Atlantic. fig. 4, Sta. 276, Tahiti. fig. 5, Sta. 47, 'Porcupine,' Faroe Channel (10. 3. 28).

f. 6. *R. ampullacea* Brady, Sta. 149 I, Kerguelen Islands (128).

f. 7–11. *R. fusiformis* (Will.); figs. 7, 8; Loch Fyne, Inverary, 30–50 fathoms. figs. 9, 10; off Ferry House, Cumbrae (10. 3. 110). fig. 11, Sta. 209, Philippine Islands (129).

f. 12 *a*, 14–17. *R. scorpiurus* Mont.; fig. 12 *a*, off Cronlin Island, Hebrides. fig. 14, Sta. 323, S. Atlantic. fig. 15, Sta. 260 A, Honolulu (130). figs. 16–17, Sta. 185, Torres Strait.

f. 18. *R. pilulifera* Brady, Sta. 31, 'Porcupine,' N. Atlantic (10. 3. 29).

f. 21, 22. *R. dentaliniformis* Brady; fig. 21, Sta. 300, N. of Juan Fernandez (131). fig. 22, Sta. 23, 'Porcupine,' N.W. of Ireland.

f. 23, 24. *R. bacillaris* Brady; Sta. 8, 'Valorous,' N. Atlantic, fig. 23 (19. 3. 122).

Pl. XXXI.

f. 1–9. *Rheophax nodulosa* Brady; figs. 1, 2; Sta. 156, Antarctic. figs. 3, 4, 6–9, Sta. 323, S. Atlantic, fig. 7 (9. 29. 23). fig. 5, Sta. 195, off Amboyna.

f. 10-15. *Rheophax guttifera* Brady, Sta. 323, S. Atlantic (133).
f. 16-17. *R. spiculifera* Brady; fig. 16, Sta. 279 c, Tahiti. fig. 17, Sta. 174 A, Fiji (134).
f. 18-22. *R. distans* Brady, Sta. 300, north of Juan Fernandez. fig. 20 (135).
f. 23-26. *R. adunca* Brady; fig. 23, Sta. 28, 'Porcupine,' N.W. of Ireland. fig. 24, Sta. 323, S. Atlantic. fig. 25, Sta. 300, N. of Juan Fernandez (137). fig. 26, Sta. 160, Southern Ocean (136).

Pl. XXXII.

f. 1-4. *Reophax membranacea* Brady, Sta. 323, S. Atlantic, fig. 1 (138).
f. 9. *R. cylindrica* Brady, Sta. 144, Prince Edward Island
f. 10, 11. *R. findens* (Parker), Gaspé Bay, mouth of St. Lawrence, 18-20 fathoms.
f. 12-14, 16-18. *Haplostiche soldanii* (J. & P.); fig. 12, Sta. 174 c, Fiji. figs. 13, 14, 16, 18; Sta. 33, off Bermudas, figs. 14, 16 (9. 29. 26). fig. 17, Sta. 24, West Indies.
f. 19-26. *Haplophragmium agglutinans* (d'Orb.); figs 19, 21, 25, 26; Sta. 218, N. of Papua. fig. 20, Sta 23, 'Porcupine,' N.W. of Ireland (10. 3. 21). figs. 22, 23; Sta. 5, Canaries. fig. 24, Sta. 64, N. Atlantic.

Pl. XXXIII.

f. 1-4. *Haplophragmium pseudospirale* (Will.); fig. 1, Sta. 1, 'Porcupine,' W. of Ireland (10. 3. 22). figs. 2-4, Sta. AA, 'Porcupine,' Skye.
f. 5-12. *H. calcareum* Brady; figs. 5, 6, 8, 12; Sta. 24, West Indies. figs. 7, 9-11; Sta. 185, Torres Strait.
f. 13-16. *H. tenuimargo* Brady, Sta. 323, S. Atlantic, figs. 13, 14 (141).
f. 17-19. *H. cassis* (Parker), Gaspé Bay, mouth of St. Lawrence, 16 fathoms.
f. 20-25. *H. foliaceum* Brady, Sta. 323, S. Atlantic, figs. 20, 21, 23 (142).
f. 26-28. *H. emaciatum* Brady; figs. 26, Sta. 24. West Indies (143). figs. 27, 28; Sta. 23, West Indies.

Pl. XXXIV.

f. 1-4. *Haplophragmium fontinense* Terquem; Sta. 323, S. Atlantic, figs. 1, 2, 3 *b*; (144).
f. 5, 6. *H. rotulatum* Brady, Sta. 5, N. Atlantic (145).
f. 7-10. *H. latidorsatum* (Born.); fig. 7, Sta. 300, N. of Juan Fernandez. figs. 8, 10; Sta. 24, West Indies, fig. 8 (9, 29. 24). fig. 9, Sta. 246, N. Pacific.
f. 11-13. *H. scitulum* Brady; figs. 11*, 12*, Sta. 47, 'Porcupine,' Faröe Channel (10. 3. 23). fig. 13, Sta. 7, 'Knight Errant,' Faröe Channel.
f. 14. *H. latidorsatum* (Born.), Sta. 174 c, Fiji.
f. 15-18. *H. glomeratum* Brady, Sta. 149 I, Kerguelen Islands (146).

Pl. XXXV.

f. 1-5. *Haplophragmium canariense* (d'Orb.); fig. 1, Sta. 135, S. Atlantic. figs. 2, 5; Loch Aloh and Loch Duich, Hebrides. fig. 3, Sta. 145, off Prince Edward Island (147). fig. 4, Dogger Bank off Scarborough, 40-50 fathoms.

f. 6–8. *Haplophragmium nanum* Brady; fig. 6, off Franz-Joseph Land, 113 fathoms (10. 3. 115). figs. 7, 8; Sta. 346, S. Atlantic.

f. 9*. *H. turbinatum* Brady, Sta. 346, S. Atlantic (148).

f. 10, 11. *H. globigeriniforme* (P. & J.); fig. 10 *a*, no locality (150). figs. 10 *b*, *c*, Sta. 323, S. Atlantic. fig. 11, Sta. 78, S.E. of Azores.

f. 13–15. *H. anceps* Brady, fig. 13, Sta. 332, S. Atlantic. figs. 14, 15; Sta. 296, S. Pacific (151).

f. 16, 17. *Placopsilina bulla* Brady, Sta. 323, S. Atlantic, fig. 16 (152).

f. 18, 19. *P. vesicularis* Brady, Sta 23, 'Porcupine,' N.W. of Ireland.

Pl. XXXVI.

f. 1–3. *Placopsilina cenomana* (d'Orb.); fig. 1, Sta. 195 A, off Amboyna (9. 29. 25). fig. 2, Sta 12, 'Porcupine,' W. of Ireland. fig 3, Sta. 122, S.E. of Pernambuco.

f. 4–6. *Bdelloidina aggregata* Carter, Sta. 218 A, Admiralty Islands. fig. 5 (9. 29. 27).

f. 7–18. *Thurammina papillata* Brady, fig. 7, Sta. 122, S.E. of Pernambuco. figs. 8, 15; Sta. 23, 'Porcupine,' N.W. of Ireland, fig. 8 (10. 3. 3). figs. 9–11; Sta. 120, off Pernambuco. figs. 12, 14, Sta. 160, Southern Ocean. fig. 13, Sta. 323, S. Atlantic. figs. 16–18, Sta. 24, 'Porcupine,' off Ireland.

Pl. XXXVII.

f. 1. *Thurammina compressa* Brady, Sta. 23, 'Porcupine,' N.W. of Ireland.

f. 2–7. *T. albicans* Brady, Sta. 323, S. Atlantic, figs. 2–4 (154).

f. 8, 9, 12, 14, 16. *Cyclammina cancellata* Brady; fig. 8, 'Porcupine,' N. Atlantic. fig. 9, Sta. 168, New Zealand. figs. 12, 14, 16; Sta. 24, West Indies, fig. 16 (9. 29. 32).

f. 17–19. *C. orbicularis* Brady; Sta. 323, S. Atlantic, fig. 18 (173).

f. 20–23. *C. pusilla* Brady; Sta. 323, S. Atlantic.

Pl. XXXVIII.

f. 1–3. *Ammodiscus incertus* (d'Orb.); figs. 1, 3; Sta. 24, West Indies (9. 29. 29). fig. 2, Sta. 332, S. Pacific.

f. 4–6. *A. tenuis* Brady; fig. 4, Sta. 46, N. Atlantic. figs. 5–6; Sta. 168, N.E. coast of New Zealand.

f. 7–9. *A. gordialis* (J. & P.); figs. 7, 8; Sta. 5, Canaries. fig. 9, Sta. 174 B, Fiji (160).

f. 10–16. *A. charoides* (J. & P.); figs. 10–12, 15; Sta. 46, N. Atlantic. figs. 13, 14; Sta. 323, S. Atlantic (161). fig. 16, Sta. 218, N. of Papua.

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f. 7–9. *H. ovicula* Brady; fig. 7, Sta. 241, N. Pacific. figs. 8 *a*, 9; Sta. 246, N. Pacific (156). fig. 8 *b*, Sta. 323, S. Atlantic.

f. 10 13. *H. monile* Brady; Sta. 122, S.E. of Pernambuco (157).

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f. 8, 9. *T. conglobata* Brady; fig. 8, Sta. 23, West Indies (165). fig. 9, Sta. 120, off Pernambuco.

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f. 1, 2. *Trochammina pauciloculata* Brady; fig. 1, Sta. 300, N. of Juan Fernandez (171). fig. 2, Sta. 279 c, Tahiti.

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f. 11. *Webbina hemisphærica* J. P. & B., off Redcliff, Durham, 30 fathoms.

f. 12–14, 16. *W. clavata* J. & P.; figs. 12, 13; Sta. 122, S.E. of Pernambuco (9. 29. 31). fig. 14, Sta. 323, S. Atlantic. fig. 16, Sta. 164 A, off Sydney.

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f. 1–5. *Textularia folium* P. & J.; figs. 1, 2; Sta. 162, Bass Strait. fig. 3, Sta. 174 A, Fiji. figs. 3 *b*, 4, 5; Sta. 185, Bass Strait, fig. 3 *b* (175).

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f. 12. *T. agglutinans* d'Orb., Sta. 24, West Indies.
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f. 15-18. *L. apiculata* Reuss; figs. 15-17; Stas. 67-8, 'Porcupine,' E. of Shetland. figs. 15, 16 (10. 3. 20). fig. 18, Sta. 67-68, E. of Shetland.
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f. 16, 17. *L. semistriata* Will., fig. 16, Sta. 217 A, Papua (297). fig. 17, Sta. 67 & 68, 'Porcupine,' E. of Shetland.
f. 18. *L. semistriata* Will. (?), Sta. 185, Torres Strait.
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f. 4. Apiculate form of *L. sulcata* Will., Sta. 276, N. of Tahiti.
f. 5, 6. Apiculate form of *L. sulcata* var. *interrupta* Will., Sta. 276, N. of Tahiti.
f. 7–10. *L. gracilis* Will.; fig. 7, Sta. 283, S. Pacific. fig. 8, Sta. 276, N. of Tahiti. fig. 9, Sta. 306, W. coast of Patagonia. fig. 10, Sta. 192, Ki Island.
f. 11–15. *L. distoma* P. & J.; fig. 11, Sta. 149 I, Kerguelen Islands (288). figs. 12–15, Sta. 67–68, 'Porcupine,' E. of Shetland.
f. 16. *L. distoma-margaritifera* P. & J., Sta. 162, Bass Strait.
f. 17. Apiculate form of *L. sulcata* W. & J. (?), Sta. 276, N of Tahiti.
f. 18. Apiculate form of *L. sulcata* W. & J., Sta. 232, S of Japan (293).
f. 19. *L. gracilis* Will., Sta. 145, Prince Edward Island.
f. 20. *L. acuticosta* Reuss (?), Sta. 241, N. Pacific.
f. 21. *L. acuticosta* Reuss, Sta. 271, S. Pacific.
f. 22–24. *L. gracilis* Will.; figs. 22, 23; Sta. 276, N. of Tahiti. fig. 24, Sta. 271, S. Pacific.
f. 25, 27. *L. plumigera* Brady, Sta. 271, S. Pacific. fig. 27 (296).
f. 26. *L. plumigera* Brady (?), Sta. 276. N. of Society Islands.
f. 28, 29, 31. *Lagena squamosa* (Mont.); fig. 28, Sta. 151, Heard Island. fig. 29, Sta. 149 D, Kerguelen Islands (307). fig. 31, St. 145, Prince Edward Island.
f. 32, 33. *L. hexagona* (Will.); fig. 32, Sta. 160 A, Honolulu. fig. 33, Sta. 271, S. Pacific (308).
f. 34*. *L. seminuda* Brady, Sta 302, S. Pacific (309).
f. 35. *L favoso-punctata* Brady, Sta. 185, Torres Strait (310)
f. 36. *L. hertwigiana* Brady, Sta. 185, Torres Strait (306).
f. 37. *L. striatopunctata* P. & J., Sta. 241, N. Pacific.
f. 38, 39. *L. fieldeniana* Brady; fig. 38, Sta. 241, N. Pacific. fig 39, Sta. 332, S. Atlantic (341).
f. 40. *L. striatopunctata* P. & J., Sta. 185, Torres Strait (302).
f. 41. *L. torquata* Brady, Sta. 300, N. of Juan Fernandez (305).
f. 42, 43. *L. desmophora* R. Jones; fig. 42, Sta. 120, off Pernambuco (304). fig. 43, Sta. 224, N. Pacific.

Pl. LIX.

f. 1. *Lagena orbignyana* (Seguenza), Sta. VIII., Canaries (321).
f. 2. *L. hispida* Reuss var., Sta. 24, West Indies.
f. 3. *L. quadrata* (Will.), Stas. 67–8, 'Porcupine,' E. of Shetland (10. 3. 18).
f. 4. *L. favoso-punctata* Brady, Sta. 219 A, Admiralty Islands.
f. 5. *L. hispida* Reuss var., Sta. 241, N. Pacific.
f. 6. *L. acuta* (Reuss) not typical, Sta. 332, S. Atlantic (312).

f. 7. *Lagena quadricostulata* Reuss (?), Sta. 332, S. Atlantic (335).
f. 8–11. *L. staphyllearea* (Schwag.); fig. 8, Sta. 151, Heard Island. figs. 9, 10; Sta. 149 D, Kerguelen Islands (313). fig. 11, Sta. 160, Southern Ocean.
f. 12. *L. unguiculata* Brady, Sta. 332, S. Atlantic (314).
f. 13, 14. *L. longispina* Brady, Sta. 98, African Coast.
f. 15. *L. quadricostulata* Reuss, Sta. 149 D, Kerguelen Islands (342).
f. 16*. *L. quadrata* (Will.), Sta. 135' Tristan d'Acunha.
f. 17. *L. marginata* var. *semimarginata* Reuss, Sta. 145, Prince Edward Island
f. 18. *L. orbignyana* (Seg.) var., Sta. 145, Prince Edward Island.
f. 19. *L. marginata* var. *semimarginata* Reuss, Sta. 332, S. Atlantic (318).
f. 21, 23. *L. marginata* W. & B.; figs. 21, 22; Sta. 300, N. of Juan Fernandez. fig. 22 (317). fig. 23, Sta. 168, N.E. of New Zealand.
f. 24–26. *L. orbignyana* (Seg.); fig. 24, Sta. 300, N. of Juan Fernandez, also Sta. 191 A, Ki Islands (332). fig. 25. Sta. 296, S.W. of Juan Fernandez. fig. 26, Sta. 271, S. Pacific.
f. 27. *L. siliqua* R. Jones, Sta. 346, S. Atlantic (319).
f. 28–30. *L. seminiformis* Schwager; fig. 28, Sta. 224, N. Pacific. fig. 29, Sta. 296, S. Pacific (320). fig. 30, Sta. 283, S. Pacific

Pl. LX.

f. 1. *Lagena castrensis* Schwag., Sta. 162, Bass Strait (333).
f. 3. *L. castrensis* Schwag. (?), Sta. 185, Torres Strait.
f. 4. *L. clathrata* Brady, Sta. 191, Arron Islands (Cambridge), or Sta. 191 A, Ki Islands (334).
f. 5. *L. quadrata* (Will.) var., Sta. 162, Bass Strait.
f. 6, 7. *L. lagenoides* (Will.); fig. 6, Sta. 164 A, Sydney. fig. 7, Sta. 120, off Pernambuco (321).
f. 8 *L. formosa* Schwag. (?), Sta. 162, Bass Strait.
f. 9*. *L. lagenoides* (Will.), Sta. 5, S.W. of Canaries.
f. 10. *L. formosa* Schwag., Sta. 145, Prince Edward Island.
f. 11. *L. lagenoides* var. *tenuistriata* Brady, Sta. 338, S. Atlantic (322).
f. 12–14. *L. lagenoides* (Will.); figs. 12, 13; Sta. 185, Torres Strait. fig. 14, Sta. 85, Canaries.
f. 15, 16. *L. lagenoides* var. *tenuistriata* Brady; fig. 15, Sta. 338, S. Atlantic. fig. 16, Sta. 23, N.W. of Ireland.
f. 17. *L. formosa* Schwag. (?), Sta. 352, Cape Verde Islands.
f. 18–20. *L. formosa* Schwag.; figs. 18, 20; Sta. 283, S. Pacific (323). fig. 19, Sta. 218, N. of Papua.
f. 21. *L. formosa* var. *favosa* Brady, Sta. 224, N. Pacific (9.29.47).
f. 22. *L. formosa* var. *comata* Brady, Sta. 224, N. Pacific (9. 29. 47).
f. 23. *L. squamosa-alata* Brady, Sta. 23, 'Porcupine,' N.W. of Ireland (Cambridge), and (10. 3. 19).
f. 24. *L. squamosa-marginata* P. & J., Sta. 168, New Zealand (325).
f. 25. *L. alveolata* var. *caudigera* Brady, Sta. 296, S. Pacific (340).
f. 26–28. *L. fimbriata* Brady; fig. 26, Sta. 271, S. Pacific. fig. 27, Sta. 276, N. of Tahiti. fig. 28, Sta. 191 A, Ki Islands (336).
f. 29. *L. auriculata* Brady, Sta. 276, S. Pacific (337).
f. 30. *L. alveolata* Brady, Sta. 64, N. Atlantic.
f. 31. *L. auriculata* Brady (?), Sta. 346, S. Atlantic.
f. 32. *L. alveolata* Brady, Sta. 332, S. Atlantic (329).

f. 33. *Lagena auriculata* Brady, Sta. 5, S.W. of Canaries.
f. 34. *L. alveolata* var. *substriata* Brady, Sta. 146, Southern Ocean.
f. 35–37. Winged variety of *Lagena sulcata* W. & J.; fig. 35, Sta. 276, N. of Tahiti. fig. 36, Sta. 5, S.W. of Canaries. fig. 37, Sta. 224, N. Pacific.
f. 38. *L. auriculata* var. *costata* Brady, Sta. 276, S. Pacific (338).

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f. 1. *Lagena variata* Brady, Sta. 162, Bass Strait (289).
f. 2. *L. favoso-punctata* Brady, Sta. 219 A, Admiralty Islands.
f. 3. *L. quadralata* Brady, Sta. 160, Southern Ocean (295).
f. 4. *L. multicosta* Karrer, Sta. 346, S. Atlantic (298).
f. 5. *L. exsculpta* Brady, Sta. 168, N.E. of New Zealand.
f. 6, 7. *L. wrightiana* Brady, Sta. 219 A, Admiralty Islands (326).
f. 9. *L. radiato-marginata* P. & J., Sta. 185, Torres Strait.
f. 10. *L. schulzeana* Brady, Sta. 185, Torres Strait (327).
f. 11. *L. trigono-oblonga* Seguenza & Siddall, Sta. 279 C, Tahiti (316).
f. 12–14. *L. trigono-marginata* P. & J.; fig. 12 *a*, *b*; Sta. 6, 'Porcupine,' W. of Ireland, fig. 12 *a* (317). fig. 13, Sta. 241, N. Pacific. fig. 14, Sta. 218, N. of Papua [specimen lost] (218).
f. 15, 16. *L. quinquelatera* Brady; fig. 15, Sta. 276, S. Pacific (330). fig. 16, Sta. 145, off Prince Edward Island.
f. 17–19. *Nodosaria* (*Glandulina*) *rotundata* Reuss, Sta. 36, 'Porcupine,' S.W. of Ireland.
f. 20–22. *N.* (*Glandulina*) *lævigata* d'Orb.; Sta. 24, West Indies (345).
f. 23–27. *N. calomorpha* Reuss; figs. 23–26, Sta. 315 A, Falkland Islands (349). fig. 27, Sta. 332, S. Atlantic.
f. 28–31. *N. radicula* (Linné); figs. 28, 31; Sta. 166, west of New Zealand. figs. 29, 30; Sta. 174 C, Fiji (346).
f. 32. *N.* (*Glandulina*) *æqualis* (Reuss), Sta. 24, West Indies (376).

Pl. LXII.

f. 1, 2. *Nodosaria radicula* var. *annulata* Terq. & Berth., Sta. 192, Ki Islands (347).
f. 3. *N. radicula* var. *ambigua* Neugeb., Sta. 192, Ki Islands (348).
f. 4, 5. *N. simplex* Silvestri, Sta. 192, Ki Islands (362).
f. 6. *N. simplex* Silv. (?), Sta. 166, W. coast of New Zealand.
f. 7, 8. *N. subtertenuata* Schwager, Sta. 192, Ki Islands (362).
f. 9. *N. inflexa* Reuss, Sta. 174 C, Fiji (351).
f. 10–12. *N. pyrula* d'Orb., fig. 10, Sta. 191 A, Ki Islands (350). figs. 11, 12; Sta. 209, Philippines.
f. 13–16. *N. soluta* Reuss; figs. 13, 14; Sta. 24; West Indies (357). figs. 15, 16; Sta. 23, 'Porcupine,' N.W. of Ireland.
f. 17, 18. *N. farcimen* (Soldani), Sta. 24, West Indies (352).
f. 19–22. *N. communis* d'Orb.; fig. 19, Sta. 24, West Indies. fig. 20, Sta. 33, Bermudas (359). figs. 21, 22; Sta. 174 A, Fiji.
f. 23, 24. *N. consorbrina* d'Orb.; fig. 23, Sta. 191 A, Ki Islands (354). fig. 24, Sta. 300. N. of Juan Fernandez.
f. 25, 26. *N. consorbrina* var. *emaciata* Reuss, Sta. 24, West Indies (355).
f. 27–31. *N. mucronata* (Neugeb.); fig. 27, Sta. 300, N. of Juan Fernandez (361). figs. 28, 29, 31; Sta. 332, S. Atlantic, fig. 31 (monstrous). fig. 30 (monstrous), Sta. 272, S. Pacific.

Pl. LXIII.

f. 1. *Nodosaria roemeri* (Neugeb.), Sta. 24, West Indies (360).
f. 2. *N. plebeia* Reuss, Sta. 33, Bermudas (356).
f. 3–5. *N. filiformis* (d'Orb.); figs. 3, 4; Sta. 33, Bermudas, fig. 3 (353); fig. 4 (359). fig. 5, Sta. 145, Prince Edward Island.
f. 6. *N.* (*Glandulina*) *armata* Reuss, Sta. 36, 'Porcupine,' S.W. of Ireland (10. 3. 44).
f. 7. *N. retrorsa* (Reuss), Sta. 191 A, Ki Islands (354).
f. 8, 9. *N.* (?) *abyssorum* Brady, Sta. 296, S. Pacific (358).
f. 10, 11. *N. papillosa* Silv. (?); fig. 10, Sta. 174 C, Fiji. fig. 11, Sta. 217 A, Papua.
f. 12–16. *N. hispida* d'Orb.; figs. 12–14, Sta. 167, W. coast of New Zealand. fig. 15, Sta. 166, W. coast of New Zealand. fig. 16, Sta. 24, West Indies (363).
f. 17, 18. *N. verruculosa* Neugeb., Sta. 192, Ki Islands (365).
f. 19–22. *N. hispida* var. *sublineata* Brady, Sta. 33, Bermudas (364).
f. 23–27. *N. costulata* Reuss; figs. 23, 25–27; Sta. 33, Bermudas. fig. 24, Sta. 24, West Indies (374).
f. 28–31. *N. scalaris* (Batsch); fig. 28, Sta. 10, 'Porcupine,' W. of Ireland (10. 3. 43). figs. 29–31; Sta. 209, Philippines.
f. 32–34. *N. catenulata* Brady, Sta. 209, Philippines (373).
f. 35. *N. vertebralis* (Batsch), Sta. 209, Philippines.

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f. 1–5. *Nodosaria comata* (Batsch); figs. 1, 2, 4, 5; Sta. 33, Bermudas, fig. 3, Sta. 23, West Indies (366).
f. 6–10. *N. raphanus* (Linné), Sta. 174 C, Fiji, fig. 8 (9. 29. 48).
f. 11–14. *N. vertebralis* (Batsch), Sta. 33, Bermudas, figs. 11, 14 (372).
f. 15. *N. proxima* Brady, Sta. 209, Philippines (368)
f. 16–19. *N. scarlaris* var. *separans* Brady, Sta. 166, W. coast of New Zealand, figs. 16, 19 (367).
f. 20–22. *N. obliqua* (Linné); figs. 20, 21; Sta. 51, 'Porcupine,' Faroe Channel (10. 3. 42). fig. 22, Sta. 23, 'Porcupine,' N.W. of Ireland.
f. 23, 24. *N. subcanaliculata* Neugeb. (var.), Sta. 279 A, Tahiti (370).
f. 25–27. *N. perversa* Schwager, Sta. 192, Ki Islands (369).
f. 28. *N. soluta* Reuss (striate specimen), Sta. 23, West Indies.

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f. 1–4. *Nodosaria intercellularis* Brady, Sta. 33, Bermudas (375).
f. 5, 6. *Marginulina glabra* d'Orb., Sta. 216, N. Pacific, fig. 6 (385).
f. 7–9. *Amphicoryne falx* (J. & P.), Sta. 166, W. coast of New Zealand, figs. 8, 9 (9. 29. 55).
f. 10–13. *Marginulina costata* (Batsch); fig. 10, Sta. 346, S. Atlantic. fig. 11, Sta. 26, West Indies. fig. 12, Sta. 33, Bermudas. fig. 13, Sta. 323, S. Atlantic (9. 29. 52).
f. 14, 15. *Lingulina carinata* var. *seminuda* Hantk.; Sta. 24, West Indies, fig. 15 (9. 29. 49).
f. 16, 17. *L. carinata* d'Orb.; fig. 16, Sta. 191 A, Ki Islands (377). fig. 17, Sta. 135, Tristan d'Acunha.
f. 18. *Frondicularia spathulata* Brady, Sta. 192, Ki Islands (378).
f. 19. *F. compta* Brady, Sta. 162, Bass Strait (384).
f. 20–23. *F. alata* d'Orb., fig. 20, Sta. 24, West Indies. figs. 21–23; Sta. 33, Bermudas; figs. 22, 23 (9. 29. 50).

Pl. LXVI.

f. 1, 2. *Frondicularia robusta* Brady; fig. 1, Sta. 192, Ki Islands (382). fig. 2, Sta. 200 A, Honolulu.
f. 3–5. *F. aluta* d'Orb.; figs. 3, 5; Sta. 33, Bermudas (9. 29. 50). fig. 4. Sta. 24, West Indies (381).
f. 6, 7. *F. interrupta* Karrer, Sta. 192, Ki Islands (378).
f. 8–12. *F. inæqualis* Costa; figs. 8–10; Sta. 191 A, Ki Islands (380). figs. 11, 12; Sta. 192, Ki Islands.
f. 13–15. *Vaginulina legumen* (Linné); figs. 13, 14; Mounts Bay, Cornwall. fig. 15, Sta. 279 c, Tahiti (386).
f. 16. *V. margaritifera* (Batsch), Sta. 27, 'Porcupine,' Rockall Bank (10. 8. 31).
f. 17. *Cristellaria obtusata* Reuss, Sta. 185, Torres Strait (390).
f. 18, 19. *Vaginulina bruckenthali* Neugeb., Sta. 185, Torres Strait (387).
f. 20. Intermediate form, Sta. 279 c, Tahiti.
f. 21–23. *Cristellaria tenuis* (Born.); fig. 21, Sta. 166, W. coast of New Zealand. figs. 22, 23; Sta. 185, Torres Strait, fig. 23 (390).
f. 24, 25. *C. obtusata* var. *subalata* Brady, Sta. 23, West Indies (391)

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f. 1–3. *Rhabdogonium tricarinatum* (d'Orb.); figs. 1, 2; Sta. 33, Bermudas (9. 29. 51). fig. 3, Sta. 192, Ki Islands.
f. 4 6. *R. minutum* Reuss, Sta. 192, Ki Islands (384).
f. 7. *Cristellaria schlonbachi* Reuss, Sta. 33, Bermudas (395).
f. 8. *C.* sp., Sta. 185, Torres Strait.
f. 9. *C. italica* var. *volpicelli* Costa, Sta. 335, S. Atlantic (405).
f. 10–12. *Vaginulina linearis* (Mont.), Sta. 24, West Indies (388).
f. 13, 14 *V. spinigera* Brady; fig. 13. Sta. 51, 'Porcupine,' Faroe Channel. fig. 14, Sta. 23, 'Porcupine,' N.W. of Ireland (10. 3. 32).
f. 15, 16. *V. patens* Brady, Sta. 209, Philippines (389).
f. 17. *Cristellaria crepidula* (F. & M.), Sta. 192, Ki Islands (401).
f. 18. *C. lata* (Corn.), Sta. 162, Bass Strait (396).
f. 19, 20. *C. crepidula* (F. & M.); fig. 19, Sta. 75, Azores. fig. 20 *a*, Sta. 23, West Indies. fig. 20 *b*, Sta. 33, Bermudas.

Pl. LXVIII.

f. 3, 4*. *Cristellaria tricarinella* Reuss; fig. 3, Sta. 209, Philippines. fig. 4, Sta. 167, W. coast of New Zealand (398).
f. 5 9. *C. siddalliana* Brady, Sta. 174 c, Fiji, fig. 5 (399).
f 10. *C. cassis* F. & M., Sta. 174 c, Fiji (414).
f. 11–16. *C. variabilis* Reuss; figs. 11, 12, 16; 'Porcupine,' Sta. (?), N. Atlantic. fig. 13, Sta. 24, West Indies. figs. 14, 15; Sta. VIII., Canaries. fig. 15 (400).
f. 17, 18. *C. italica* (Defr.); fig. 17, Sta. 24, West Indies. fig. 18, Sta. 174 c, Fiji.
f. 19. *C. latifrons* Brady, Sta. 167, W. coast of New Zealand (403).
f. 20–23. *C. italica* (Defr.), Sta. 174 c, Fiji, figs. 20, 23 (405).

Pl. LXIX.

f. 1–4. *Cristellaria articulata* Reuss, Sta. 135, Tristan d'Acunha.
f. 5. *C.* sp., Sta. 42, 'Porcupine,' S.W. of Ireland.
f. 6, 7. *C. convergens* Bornemann; fig. 6, Sta. 224, N. Pacific. fig. 7, Sta. 300, N. of Juan Fernandez (406).

f. 8, 9. *Cristellaria gibba* d'Orb., Sta. 24. West Indies (407).
f. 10–12. *C. articulata* Reuss; figs. 10 *a*, 10 *b*; Sta. 24, West Indies, fig. 10 *a* (408), fig. 10 *b* (423). figs. 11, 12; Sta. 185, Tristan d'Acunha.
f. 13. *C. rotulata* (Lam.), Sta. 24, West Indies (9. 29. 54).
f. 14–16. *C. vortex* (F. & M.), Sta. 174 c, Fiji (409).
f. 17. *C. orbicularis* (d'Orb.), Sta. 174 c, Fiji (409).

Pl. LXX.

f. 1. *Cristellaria crassa* d'Orb., Sta. 174 c, Fiji (410).
f. 2. *C. nitida* d'Orb., Sta. 209, Philippines (411).
f. 3. *C. reniformis* d'Orb., Sta. 24, West Indies (394).
f. 4–8. *C. cultrata* (Mont.); figs. 4, 5; Sta. 24, West Indies (412). figs. 6–8; Sta. 174 c, Fiji.
f. 9–15. *C. calcar* (Linné); figs. 9, 10; Sta. 209, Philippines. figs. 11, 13, 14; Sta. 23, West Indies. fig. 12, Sta. 24, West Indies (413). fig. 15, Sta. 174 c, Fiji.
f. 16. *C. papillosa* F. & M., Sta. 174 c, Fiji (416).
f. 17, 18. *C. mamilligera* Karrer, Sta. 174 c, Fiji (415).

Pl. LXXI.

f. 1–3. *Cristellaria echinata* (d'Orb.); fig. 1, Sta. 209, Philippines. figs. 2, 3; Sta. 174 c, Fiji (417).
f. 4, 5. *C. aculeata* d'Orb., Sta. 24, West Indies.
f. 6, 7. *C. gemmata* Brady; fig. 6, Sta. 174 c, Fiji; fig. 7, Sta. 209, Philippines (419).
f. 8, 9. *C. costata* (F. & M.); fig. 8, Sta. 174 c, Fiji (421). fig. 9, Sta. 185, Torres Strait.
f. 10. Dimorphous specimen, Sta. 162, Bass Strait.
f. 11. *Polymorphina lactea* W. & J., Sta. 162, Bass Strait (424).
f. 12. *P. gibba* d'Orb., Dog's Bay, Connemara (10. 8. 111).
f. 13. *P. amygdaloides* Reuss, Sta. 162, Bass Strait (427).
f. 14. *P. lactea* W. & J., Sta. 241, N. Pacific (425).
f. 15, 16. *P. sororia* Reuss; fig. 15, Sta. 84, 'Porcupine,' Faröe Channel. fig. 16, Sta. 205 A, Hongkong (429).
f. 17–19. *P. sororia* var. *cuspidata* Brady; fig. 17, Sta. 146, Southern Ocean (431). figs. 18, 19; Sta. 18, 'Porcupine,' W. of Ireland.

Pl. LXXII.

f. 1–3. *Polymorphina angusta* Egger; fig. 1, Sta. 332, S. Atlantic (432). fig. 2, Sta. 346, S. Atlantic. fig. 3, Sta, 300, N. of Juan Fernandez.
f. 4. *P. sororia* var. *cuspidata* Brady, Sta. 2, 'Porcupine,' W. of Ireland.
f. 5, 6. *P. lanceolata* Reuss; fig. 5, Sta. 296, S. Pacific (433). fig. 6, Sta, 146, Southern Ocean (431).
f. 7, 8. *P. ovata* d'Orb., Sta. 24, West Indies, fig. 7 (434).
f. 9–11. *P. compressa* d'Orb.; figs. 9, 10; Sta. 162, Bass Strait (9. 29. 56). fig. 11, Dog's Bay, Connemara, Ireland.
f. 12–15. *P. elegantissima* P. & J.; figs. 12, 14, 15; Sta. 192, Ki Islands. fig. 12 *b*, Sta. 162, Bass Strait. fig. 13, Sta. 185, Torres Strait (436).
f. 16, 17. *P. seguenzana* Brady, Sta. 192, Ki Islands, fig. 17 (437).
f. 18. *P. thouini* d'Orb., Sta. 162, Bass Strait (438).
f. 19. *P. communis* d'Orb., Sta. 162, Bass Strait (441).
f. 20. *P. problema* d'Orb., Sta. 162, Bass Strait (440).

Pl. LXXIII.

f. 1. *Polymorphina problema* d'Orb., Sta. 162, Bass Strait (439).
f. 2–4. *P. oblonga* d'Orb.; fig. 2, Sta. 162, Bass Strait. fig. 3, Sta. 163 c, Port Jackson (442). fig. 4, Sta. 192, Ki Islands.
f. 5–8. *P. rotundata* (Born.); fig. 5, Sta. 296, S. Pacific (433). fig. 6, Sta. 224, N. Pacific. figs. 7, 8; Sta. 145, Prince Edward Island (443).
f. 9, 10. *P. myristiformis* Will., Mounts Bay, Cornwall.
f. 11–13. *P. regina* B. P. & J.; figs. 11, 12; Sta. 163 c, Port Jackson (444). fig. 13; Sta. 185, Torres Strait.
f. 14. *P. lactea* W. & J. (fistulose form), Sta. 24, West Indies (426).
f. 15. *P. sororia* Reuss (fistulose form), Sta. 246, N. Pacific (430).
f. 16. *P. gibba* d'Orb., Sta. 162, Bass Strait (428).
f. 17. *P. compressa* d'Orb. (fistulose form), Sta. 33, Bermudas (435).
f. 18, 19. *P. longicollis* Brady; fig. 18, Sta. 283, S. Pacific. fig. 19, Sta. 338, S. Atlantic (445).

Pl. LXXIV.

f. 1–3. *Uvigerina canariensis* d'Orb.; fig. 1, Sta. 323, S. Atlantic. fig. 2, Sta. 309, W. coast of Patagonia (447). fig. 3, Sta. 33, Bermudas (446).
f. 4–7. *U. tenuistriata* Reuss; figs. 4, 5; Sta. 185, Torres Strait. figs. 6, 7; Sta. 151, Heard Island (448).
f. 8–10. *U. schwageri* Brady; figs. 8, 9; Sta. 147 c, Fiji (449). fig. 10, Sta. 209, Philippines.
f. 11–14. *U. pygmæa* d'Orb.; figs. 11, 12; Sta. 24, West Indies (9. 29. 57). figs. 13, 14; Sta. 232, S. of Japan.
f. 15–18. *U. angulosa* Will.; figs. 15, 16; Sta. 145, Prince Edward Island. figs. 17, 18; Sta. 300, N. of Juan Fernandez (450).
f. 19, 20. *U. angulosa* var. *spinipes* Brady, Sta. 135, off Tristan d'Acunha (451).
f. 21–23. *U. porrecta* Brady, Sta. 185, Torres Strait (452).
f. 24–26. *U.* sp.; figs. 24, 25; Sta. 191 A, Ki Islands (458). fig. 26, Sta. 300, N. of Juan Fernandez.

Pl. LXXV.

f. 1–3. *Uvigerina aculeata* d'Orb., Sta. 191 A, Ki Islands, figs. 1, 3 (454).
f. 4, 5. *U. brunnensis* Karrer, Sta. 149 I, Kerguelen Islands (453).
f. 6–8. *U. asperula* Czjzek; figs. 6, 7; Sta. 191 A, Ki Islands; fig. 6 (455). fig. 8, Sta. 323, S. Atlantic.
f. 9. *U. asperula* var. *auberiana* d'Orb., Sta. 191 A, Ki Islands (454).
f. 10, 11. *U. asperula* var. *ampullacea* Brady, Sta. 344, Ascension Island (456).
f. 12–14. *U. interrupta* Brady, figs. 12, 13; Sta. 217 A, Papua (457). fig. 14, Sta. 174 c, Fiji.
f. 15–17. *Sagrina columellaris* Brady; figs. 15, 16; Sta. VIII., Canaries (459). fig. 17, Sta. 162, Bass Strait.
f. 18–20. *S. bifrons* Brady, Sta. 232, off Japan, fig. 20 (460).
f. 21–24. *S. raphanus* Brady; fig. 21, Sta. 162, Bass Strait (9. 29. 58). fig. 22, Sta. 218 A, Admiralty Islands. fig. 23 *b*, Sta. 209, Philippines. fig. 24, Sta. 279 A, Tahiti.
f. 25, 26. *S. striata* Schwager; fig. 25, Sta. 192, Ki Islands (64). fig. 26, Sta. 209, Philippines.

Pl. LXXVI.

f. 1–3. *Sagrina dimorpha* P. & J.; fig. 1, Sta. 191 A, Ki Islands. figs. 2, 3; Sta. 279 A, Tahiti (461).

f. 4–8. *S. virgula* Brady; fig. 4, Sta. 195 A, off Amboyna. figs. 5, 6, 7; Sta. 217 A, Papua. figs. 6, 7 (462). fig. 8, Sta. 120, off Pernambuco (462). [2 slides bear this number.]

f. 11–16. *Nubecularia divaricata* Brady; figs. 11–15; Sta. 217 A, Papua. figs. 11–13 (3). fig. 16, Sta. 172, Friendly Islands.

f. 17–19. *Sagrina* (?) *tessellata* Brady, Sta. 219 A, Admiralty Islands (465).

f. 20, 21. *S.* (?) *annulata* Brady, Sta. 260 A, Honolulu (466).

f. 22–24, 26, 27. *Ramulina globulifera* Brady; figs. 22–24, 27; Sta. 174 C, Fiji. figs. 22, 23, 27 (9. 29. 59). fig. 26, Sta. 23, West Indies.

Pl. LXXIX.

f. 6, 7. *Globigerina bulloides* d'Orb.; fig. 6, Shetland, 40–60 faths. (?). fig. 7, Sta. 232, S. of Japan (9. 29. 60).

f. 8*, 9*. *G. inflata* d'Orb.; Sta. 232, S. of Japan (478), or Sta. 323, S. Atlantic.

f. 11–16. *G. rubra* d'Orb.; figs. 11, 13–15; Sta. 338, S. Atlantic, figs. 13–15 (479). fig. 12, Sta. 344, Ascension Island. fig. 16, Sta. 346, S. Atlantic (480).

f. 17. *G. dubia* Egger, Sta. 300, N. of Juan Fernandez, or (?) Sta. 5, N. Atlantic (473).

Pl. LXXX.

f. 2. *Globigerina conglobata* Brady, Sta. 64, N. Atlantic ? (481).

f. 6–10. *G. digitata* Brady; figs. 6, 7*, 9*; Sta. 276, S. Pacific (475). figs. 8, 10; Sta. 338, S. Atlantic.

f. 11–14. *G. sacculifera* Brady; figs. 11, 13, 14; Sta. 224, N. Pacific (482). fig. 12, Sta. 24, W. Indies.

f. 19. *G. æquilateralis* Brady, Sta. 224, N. Pacific (485).

Pl. LXXXI.

f. 1. *Globigerina dutertrei* d'Orb., Sta. 155, Antarctic (477).

f. 2, 3. *G. bulloides* var. *triloba* Reuss, Sta. 344, Ascension Island (472).

f. 4, 5. *G. helicina* d'Orb.; fig. 4, Sta. 338, S. Atlantic (483), fig. 5, Sta. 85, Canaries.

f. 6, 7. *G.* monstrous, fig. 6, Sta. 388, S. Atlantic (486). fig. 7, Sta. 185, Torres Strait.

f. 8–11, 21, 26. *Orbulina universa* d'Orb.; fig. 8, Sta. 246, N. Pacific (9. 29. 61). fig. 9, ? Sta. 24, West Indies. fig. 10, ? off Seaham, Durham, 40–48 fathoms. fig. 11, Shetland, 50–60 fathoms ?. fig. 21, Sta. 78, E. of the Azores. fig. 26, Sta. 302, W. coast of Patagonia.

Pl. LXXXII.

f. 2, 3. *Orbulina universa* d'Orb.; fig. 2, Sta. 120, off Pernambuco. fig. 3, Sta. 166, W. coast of New Zealand.

f. 4. *Globigerina sacculifera* Brady; Sta. 36, surface, N. Atlantic.

f. 5. *G. conglobata*, Brady, no locality, surface.

f. 6. *G. digitata* Brady, Sta. 191 A, Ki Islands (476) or Sta. 291 A, Tahiti (510).

f. 8, 9. *G.* sp., Sta. 144, Southern Ocean (487).

f. 10. *Globigerina* (*cretacea* d'Orb. ?), Sta. 191 A, Ki Islands (474).
f. 11. *G. cretacea* d'Orb.; White Chalk, Iowa, U.S.A.
f. 13-20. *Candeina nitida* d'Orb.; fig. 13, Philippines, surface. fig. 14, Sta. 338, S. Atlantic. figs. 15-17; Sta. 280, S. Pacific (9. 29. 65). figs. 18-20; Sta. 120, off Pernambuco.

Pl. LXXXIII.

f. 5-8. *Hastigerina pelagica* (d'Orb.), Sta. 338, S. Atlantic, figs. 7, 8 (9. 29. 2).

Pl. LXXXIV.

f 1-7. *Sphæroidina bulloides* d'Orb.; fig. 1, Sta. 323, S. Atlantic figs. 2, 5-7; Sta. 120, off Pernambuco, fig. 2 (9. 29. 64) figs. 3, 4; Sta. 279 A, Tahiti.
f 8, 9, 11. *S. dehiscens* P. & J., Sta. 224, N. Pacific, figs. 8, 9 (10. 5 491).
f. 12, 13. *Pullenia sphæroides* (d'Orb.); fig 12, St. 224, N. Pacific (489). fig. 13, Sta. 332, S. Atlantic.
f. 14, 15. *P. quinqueloba* Reuss; fig 14, Sta. 149 I, Kerguelen Islands (490). fig. 15, Sta. 145, Prince Edward Island.
f. 16, 17, 19, 20. *P. obliqueloculata* P. & J.; figs. 16, 20; Sta. 224, N. Pacific, fig. 16 (9. 29. 63). fig. 17, Sta. 5, S.W. of Canaries. fig. 19, Sta. 344, Ascension Island.

Pl. LXXXV.

f. 1-5. *Spirillina vivipara* Ehrb.; fig. 1, Sta. 145, Prince Edward Island. fig. 2 *a*, Sta. 260 A, Honolulu Reefs. fig 2 *b*, Sta. 149 I, Kerguelen Islands. figs. 3, 5; Sta. 219 A, Admiralty Islands (9. 29. 66). fig. 4; Sta. 279 C, Tahiti.
f. 6, 7. *S. obconica* Brady; fig. 6, Sta. 143, Prince Edward Island. fig. 7, Sta. 149 I, Kerguelen Islands (493).
f. 8-11. *S. inæqualis* Brady; figs. 8, 10; Sta 260 A, Honolulu Reefs. figs. 9, 11; Sta. 219 A, Admiralty Islands (494).
f. 12-16. *S. tuberculata* Brady, Sta. 149 D, Kerguelen Islands.
f. 17. *S. limbata* var. *denticulata* Brady, Sta. 162, Bass Strait (498).
f. 18-20. *S. limbata* Brady; fig. 18, Sta. 145, Prince Edward Island (497). figs. 19, 20; Sta 120, off Pernambuco.
f. 23. *S. decorata* Brady, Sta. 85, Canaries (499).

Pl. LXXXVI.

f. 1-7. *Patellina corrugata* Will.; fig. 1, Sta. 162, Bass Strait. fig. 2, Sta. 174 A, Fiji (9. 29. 67). figs. 3-5; Sta. 145, Prince Edward Island. fig. 6, Sta. 149 D, Kerguelen Islands. fig. 7, Sta. 219 A, Admiralty Islands.
f 8. *Discorbina globularis* (d'Orb.), Sta. 205 A, Hongkong (500).
f. 9. *D. vilardeboana* (d'Orb.), Sta. 151, Heard Island (504).
f. 10, 11. *D. araucana* (d'Orb.); fig. 10, Sta. 149 I, Kerguelen Islands (495). fig. 11, Sta. 162, Bass Strait (519).
f. 12. *D. vilardeboana* (d'Orb.), Sta. 168, N.E. coast of New Zealand.
f. 13. *D. globularis* (d'Orb.), Sta. 33, Bermudas.

Pl. LXXXVII.

f. 1. *Discorbina rosacea* (d'Orb.), Sta. 218 A, Admiralty Islands.
f. 2. *D. vesicularis* (Lam.), Shore-sand, Melbourne (Cambridge), or Sta. 187 A, Booby Island (515).
f. 3. *D. rugosa* (d'Orb.), Sta. 185, Torres Strait (516).

f. 4. *Discorbina rosacea* (d'Orb.), Sta. 162, Bass Strait (503).
f. 5, 7. *D. valvulata* (d'Orb.); fig. 5, Sta. 162, Bass Strait (501). fig. 7, Sta. 172, Fiji.
f. 8. *D. turbo* (d'Orb.), Sta. 352 A, Cape Verde Islands (9. 29. 69).

Pl. LXXXVIII.

f. 1. *Discorbina isabelleana* (d'Orb.), Sta. 279 C, Tahiti (505).
f. 2. *D. patelliformis* Brady, Sta. 219 A, Admiralty Islands (507).
f. 4–8. *D. orbicularis* Terquem; fig. 4, Sta. 172, Friendly Islands. fig. 5, Sta. 33, Bermudas. figs. 6, 7; Sta. 185, Torres Strait (520). fig. 8, Sta. 163 B, Port Jackson.
f. 9. *D. eximia* Hantk., Sta. 185, Torres Strait (518).
f. 10. *D. pulvinata* Brady, Sta. 219 A, Admiralty Islands (512).

Pl. LXXXIX.

f. 1. *Discorbina patelliformis* Brady, Sta. 187, S. of Papua.
f. 2–4. *D. pileolus* (d'Orb.), Shore-sand, Port Elizabeth, Algoa Bay. figs. 3, 4; Sta. 163 B, Port Jackson, fig. 3 (511).
f. 5–7. *D. tabernacularis* Brady: figs. 5, 6; Sta. 187, S. of Papua. fig. 7, Sta. 219 A, Admiralty Islands (508).
f. 8, 9. *D. opercularis* (d'Orb.); fig. 8 *a*, Sta. 185, Torres Strait. figs. 8 *b*, *c*, *d*. 9; Curtis Strait, Queensland (10. 3. 113).
f. 10–12. *D. bertheloti* (d'Orb.); figs. 10, 11; Sta. 209, Philippines (513). fig. 12, Sta. 6, W. of Ireland.

Pl. XC.

f. 1. *Discorbina bertheloti* var. *baconica* Hantk.; fig. 1 *a*, Sta. 17, 'Porcupine,' W. of Ireland (10. 3. 45). figs. 1 *b*, *c*, Sta. VIII., Canaries.
f. 2, 3. *D. rarescens* Brady, Sta. 185, Torres Strait (514).
f. 4. *D.* sp., Sta. 185, Torres Strait.
f. 5, 6. *D. parisiensis* (d'Orb.), fig. 5, Sta. 149 D, Kerguelen Islands. fig. 6, Sta. 149 E, Kerguelen Islands.
f. 7, 8. *D. concinna* Brady, Sta. 279 C, Tahiti (506).
f. 10–12. *D. parisiensis* (d'Orb.), Sta. 149 D, Kerguelen Islands, fig. 12 (509).

Pl. XCI.

f. 1. *Discorbina polystomelloides* P. & J., Sta. 186, Wednesday Island (517).
f. 2, 3. *D. biconcava* P. & J., Sta. 162, Bass Strait, fig. 2 (521).
f. 4. *D. rugosa* (d'Orb.), Sta. 191 A, Ki Islands.
f. 5. *D. allomorphinoides* (Reuss), Sta. 209, Philippines.
f. 6. *D. saulcii* (d'Orb.), Sta. 279 C, Tahiti (522).
f. 7. *D. ventricosa* Brady, Sta. 33, Bermudas (524).
f. 8. *D. allomorphinoides* (Reuss), Sta. 185, Torres Strait (523).
f. 9. *D. obtusa* ? (d'Orb.), Sta. 344, Ascension Island (502).

Pl. XCII.

f. 1–3. *Planorbulina mediterranensis* d'Orb.; fig. 1, Sta. 162, Bass Strait. fig. 2, Sta. 33, Bermudas (9. 29. 70). fig. 3, Sta. 23, 'Porcupine,' N.W. of Ireland.
f. 4. *P. acervalis* Brady, Sta. 187 A, Booby Island (555).
f. 5, 6. *P. larvata* P. & J., Sta. 172, Friendly Islands, fig. 5 (556).
f. 7–9. *Truncatulina refulgens* (Mont.); figs. 7, 9; Sta. 36, 'Porcupine,' S.W. of Ireland. fig. 8, Sta. 305, W. coast of Patagonia (9. 29. 71).
f. 10. *T. lobatula* (W. & J.), Sta. 172, Friendly Islands.

Pl. XCIII.

f. 1. *Truncatulina lobatula* (W. & J.), Sta. 354 A, Cape Verde Islands (525).

f. 2, 3. *T. tenuimargo* Brady; fig. 2, Sta. 166, W. coast of New Zealand (527). fig. 3, Sta. 174 A, Fiji.

f. 4, 5. *T. lobatula* (W. & J.); fig. 4, Sta. 246, N. Pacific. fig. 5, Sta. 300, N. of Juan Fernandez.

f. 4. *T. variabilis* d'Orb., Sta. 166, W. coast of New Zealand.

f. 8, 9. *T. wuellerstorfi* (Schwager); fig. 8, Sta. 21, 'Porcupine,' W. of Ireland. fig. 9, Sta. 166, W. coast of New Zealand (528).

f. 10, 11. *Anomalina ariminensis* (d'Orb.), Sta. 122, S.E. of Pernambuco (547).

Pl. XCIV.

f. 1. *Anomalina foveolata* Brady, Sta. 33, Bermudas (546).

f. 2, 3. *A. ammonoides* (Reuss); fig. 2; Sta. 174 C, Fiji (544). fig. 3, Sta. 217 A, Papua.

f. 4, 5. *A. grosserugosa* (Gümb.); fig. 4, Sta. 344, Ascension Island (545). fig. 5, Sta. 246, N. Pacific.

f. 6. *Truncatulina rostrata* Brady, Sta. 217 A, Papua (540).

f. 7. *T. humilis* Brady, Sta. 5, S.W. of Canaries, or Sta. 276, S. Pacific (534).

f. 8. *T. akneriana* (d'Orb.), Sta. 120, off Pernambuco (530).

f. 9. *T. ungeriana* (d'Orb.), Sta. 42, S.W. of Ireland.

Pl. XCV.

f. 1–3. *Truncatulina præcincta* (Karrer); fig. 1, Sta. 209, Philippines. fig. 2, Sta. 217 A, Papua (537), fig. 3, Sta. 219 A, Admiralty Islands.

f. 4. *T. robertsoniana* Brady, Sta. 24, West Indies (531).

f. 5. *T. dutemplei* (d'Orb.), Sta. 323, S. Atlantic (533).

f. 6. *T.* sp., Sta. 296, S. Pacific (543).

f. 7. *T. haidingeri* (d'Orb.), Sta. 185, Torres Strait (529).

f. 8. *T. tumidula* Brady, Sta. 5, N. Atlantic (535).

f. 9, 10. *T. pygmæa* Hantk.; fig. 9, Sta. 64, N. Atlantic. fig. 10, Sta. 5, N. Atlantic (536).

f. 11. *T. tenera* Brady, Sta. 305, W. coast of Patagonia (532).

Pl. XCVI.

f. 1. *Truncatulina rosea* (d'Orb.), Shore Sand, Cuba (Cambridge) & (10. 3. 109).

f. 2. *T. margaritifera* Brady, Sta. 209, Philippines (538).

f. 3. *T. culter* (P. & J.), Sta. 191 A, Ki Islands (539).

f. 4. *T. soluta* Brady, Sta. 24, West Indies (London, specimen lost).

f. 5–8. *T. reticulata* (Czjzek); fig. 5, Sta. 162, Bass Strait. figs. 6, 7; Sta. 174 A, Fiji (541). fig. 8, Sta. 24, West Indies.

f. 9–14. *T. echinata* Brady; fig. 9, Sta. 185, Torres Strait. figs. 10, 13, 14; Sta. 260 A, Honolulu. figs. 11, 12; Sta. 219 A, Admiralty Islands (542).

Pl. XCVII.

f. 1, 2. *Anomalina coronata* P. & J.; fig. 1, Sta. 145, Prince Edward Island. fig. 2, Sta. VIII., Canary Islands (9. 29. 72).

f. 3, 5. *A. polymorpha* Costa; fig. 3, Sta. 174 C, Fiji (544). fig. 5, Sta. 24, West Indies (548).

f. 7. *A. polymorpha* Costa (?), Sta. 33, Bermudas.

f. 8-14. *Carpenteria proteiformis* Goes; figs. 8, 10–12, 14; Sta. 24, West Indies, figs. 8, 10 (552). fig. 9, Sta. 33, Bermudas. fig. 13, Sta. 219 A, Admiralty Islands.

Pl. XCVIII.

f. 1–12. *Rupertia stabilis* Wallich, Sta. 57, 'Porcupine,' Faröe Channel.

f. 13 17. Young specimens of *Carpenteria*, Sta. 344, Ascension Island.

Pl. XCIX.

f. 2, 3, 5. *Carpenteria monticularis* Carter, Sta. 201. Philippines, figs. 3, 5 (9. 29. 73).

f. 6, 7. *C. utricularis* Carter, Sta. 218 A, Admiralty Islands.

Pl. C.

f. 1 4. *Carpenteria utricularis* Carter, Sta. 218 A, Admiralty Islands, fig. 3 (551).

f. 5–9. *Polytrema miniaceum* (Linné); fig. 5, Sta. 219 A, Admiralty Islands. figs. 6, 7; Sta. 172, Friendly Islands (608). fig. 8, Sta. 218 A, Admiralty Islands. fig. 9, Sta. 33, Bermudas.

Pl. CI.

f. 4-7. *Tinoporus baculatus* (Mont. ?) Carp.; figs. 4–6; Sta. 173 A, Fiji (9. 29. 77). fig. 7, Wednesday Island.

f. 8. *Gypsina globulus* (Reuss), Sta. 260 A, Honolulu (592).

f. 9–12. *G. vesicularis* (P. & J.); figs. 9–11; Sta. 172, Friendly Islands (9. 29. 78). fig. 12, Wednesday Island.

Pl. CII.

f. 1 6. *Gypsina inhærens* (Schul.); figs. 1, 5, 6; Dog's Bay, Connemara, Ireland. fig. 2, Sta. 172, Friendly Islands. fig. 3, Sta. 162, Bass Strait. fig. 4, Sta. 187, S. of Papua.

f. 7. *Cymbalopora (Tretomphalus) bulloides* (d'Orb.); fig 7, Pacific, surface. figs. 8, 9; Sta. 260 A, Honolulu. figs. 10, 11; Sta. 33, Bermudas (611). fig. 12, Sta. 185, Torres Strait.

f. 13. *C. poeyi* d'Orb.; Sta. 219 A, Admiralty Islands (9. 29. 68).

f. 14. *C. poeyi* d'Orb., var; fig. 14 *a, b, c*; Sta. 185, Torres Strait (612). fig. 14 *d*, Sta. 217 A, Papua.

f. 15-18. *C. tabellæformis* Brady; figs. 15, 18; Sta. 174 C, Fiji, fig. 15 (609). fig. 16, Sta. 192, Ki Islands (610). fig. 17, Sta. 209, Philippines.

Pl. CIII.

f. 1. *Pulvinulina menardii* (d'Orb.), Sta. 224, N. Pacific (9. 29. 74).

f. 3. *P. menardii* var. *fimbriata* Brady, Sta. 24, West Indies (565).

f. 4, 5. *P. tumida* Brady; fig. 4, Sta. 224, N. Pacific (566). fig. 5 Sta. 276, N. of Tahiti.

f. 7. *P. patagonica* (d'Orb.), Sta. 246, N. Pacific (568).

f. 8, 9. *P. canariensis* (d'Orb.); fig. 8, Sta. 300, N. of Juan Fernandez. fig. 9, Sta. 33, Bermudas (567).

f. 11. *P. crassa* (d'Orb.), Sta. 5, N. Atlantic (569).

f. 13, 14. *P. exigua* Brady; fig. 13; Sta. 332, S. Atlantic (572). fig. 14, Sta. 160, Southern Ocean.

Pl. CIV.

f. 1. *Pulvinulina micheliniana* (d'Orb.), Sta. 335, S. Atlantic (570).
f. 3–11. *P. pauperata* P. & J., figs. 7–9; Sta. 146, Southern Ocean. figs. 4, 6, 11; Sta. 120, off Pernambuco, figs. 4, 11 (573). figs. 5, 10; Sta. 335, S. Atlantic.
f. 12–16. *P. favus* Brady; figs. 12, 14, 15; Sta. 300, N. of Juan Fernandez, figs. 12, 15 (579). figs. 13, 16; Sta. 283, S. Pacific.
f. 17. *P. punctulata* (d'Orb.), Sta. 24, West Indies (558).
f. 18. *P. repanda* (F. &. M.), Sta. 354 A, Cape Verde Islands (557).
f. 19. *P. repanda* var. *concamerata* Will., Sta. AA, 'Porcupine,' off Loch Scavaig.

Pl. CV.

f. 1. *Pulvinulina concentrica* P. & J., Shetland, 75–90 fathoms.
f. 2. *P. umbonata* Reuss, Sta. 308, W. coast of Patagonia (571).
f. 3–6. *P. elegans* (d'Orb.); fig. 3, Sta. ?, 'Porcupine,' N. Atlantic (10. 3. 36). fig. 4, Sta. 135, Tristan d Acunha (577). fig. 5, Sta. 24, West Indies. fig. 6, Sta. 174 c, Fiji.
f. 7. *P. procera* Brady, Sta. 174 c, Fiji (575).
f. 8. *P. karsteni* (Reuss), Sta. 313, Magellan Strait (576).

Pl. CVI.

f. 1. *Pulvinulina berthelotiana* (d'Orb.), Sta. 189, S. of New Guinea (578).
f. 2, 3. *P. lateralis* (Terq.); fig. 2, Sta. 172, Friendly Islands (563). fig. 3b, Sta. 186, Wednesday Island. figs. 3 *a*, 3 *c*; Gulf of Suez, 10–16 fathoms.
f. 4. *P. oblonga* (Will.), Sta. 142, S. Africa (561).
f. 5. *P. auricula* (F. & M.), Sta. 24, West Indies (560).
f. 6, 7. *P. hauerii* (d'Orb.); fig. 6, Sta. 217 A, Papua. fig. 7, Sta. 192, Ki Islands (564).
f. 8. *P. oblonga* var. *scabra* Brady, Sta. 185, Torres Strait (562).
f. 9. *Rotalia papillosa* Brady, Sta. 188, S. of N. Guinea (585).

Pl. CVII.

f. 2. *Rotalia beccarii* (Linné), Sta. 187 A, Booby Island (580).
f. 4. *R. broekhiana* Karrer, Sta. 191 A, Ki Islands (581).
f. 5. *R. orbicularis* d'Orb. (?), Sta. 18, 'Porcupine,' W. of Ireland.
f. 6, 7. *R. soldanii* d'Orb.; fig. 6, Sta. 302, S. Pacific (584). fig. 7, Sta. 246, N. Pacific (583).
f. 8, 9. *R. clathrata* Brady; fig. 8, Sta. 162, Bass Strait (9. 29. 75). fig. 9, Sta. 305, W. coast of Patagonia.

Pl. CVIII.

f. 1. *Rotalia papillosa* var. *compressiuscula* Brady, Sta. 186, Wednesday Island (587).
f. 2. *R. venusta* Brady, Sta. 187 A, Booby Island (588).
f. 3. *R. calcar* (d'Orb.), Sta. 217 A, Papua (589).
f. 4. *R.* sp., Sta. 187, New Guinea (590).
f. 5. *Calcarina spengleri* (Linné), Sta. 218 A, Admiralty Islands (9. 29. 76).
f. 6. *C. defrancii* d'Orb., Sta. 218 A, Admiralty Islands (591).
f. 7. *C. spengleri* (Linné), Sta. 218 A, Admiralty Islands.
f. 8, 9. *C. hispida* Brady, Loo Choo Islands, washed from algæ.

Pl. CIX.

f. 1, 2. *Nonionina asterizans* F. & M., Sta. 174 c, Fiji, fig. 2 (9. 29. 80).

f. 3, 5. *N. stelligera* d'Orb.; fig. 3, Sta. 67–68, 'Porcupine,' E. of Shetland. fig. 5, Sta. 344, Ascension Island (595).

f. 6, 7. *N. depressula* W. & J., Sta. 163 c, Sydney (593).

f. 8, 9. *N. umbilicata* (Mont.); fig. 8, Sta. 24, West Indies (594). fig. 9, Sta. 276, Tahiti.

f. 10. *N. pompilioides* (F. & M.), Sta. 20, 'Porcupine,' W. of Ireland (10. 3. 40).

f. 12, 13. *N. boueana* d'Orb., Sta, 354 A, Vigo Bay (596).

f. 14–16. *N. scapha* (F. & M.); figs. 14, 15; Sta. 306, W. Coast of Patagonia (596). fig. 16, Sta. 217 A, Papua (597).

f. 17–19. *N. turgida* (Will.); figs. 17, 18; Sta. 67–68, 'Porcupine,' E. of Shetland. fig. 19, Sta. 167, W. coast of New Zealand (598).

f. 20, 21. *N. orbicularis* Brady, Sta. 57, 'Porcupine,' Faröe Channel (10. 3. 39).

f. 22, 23. *Polystomella striatopunctata* (F. & M.); fig. 22 *a*, Sta. 24, West Indies. fig. 22 *b*, Sta. 315 A, Falkland Islands (599). fig. 23, Sta. 46, N. Atlantic.

Pl. CX.

f. 1. *Polystomella subnodosa* (Munst.); fig. 1 *a*, Sta. 187 A, Booby Island (600). fig. 1 *b*, Sta. 189, S. of Papua.

f. 2–5. *P. arctica* P. & J.; fig. 2, "N. Polar Exped. 1875–6," Smith Sound. fig. 3, Sta. 57, 'Porcupine,' Faröe Channel (10. 3. 46). figs. 4, 5; "N. Polar Exped. 1875–6," off C. Frazer.

f. 6, 7. *P. crispa* (Linné), Sta. 186, Wednesday Island (9. 29. 81).

f. 8, 9. *P. macella* (F. & M.); fig. 8, Sta. 163 c, Sydney (601). fig. 9, Sta. 315 A, Falkland Islands.

f. 10. *P.* sp. (young), Sta. 315 A, Falkland Islands.

f. 11. *P. macella* (F. & M.), Sta. 142 A, S. Africa.

f. 12. *P. verriculata* Brady, Sta. 162, Bass Strait (602).

f. 13–15. *P. imperatrix* Brady, figs. 13, 14; Storm Bay, Tasmania. fig. 15, Sta. 163 B, Sydney (605).

f. 16, 17. *P. craticulata* (F. & M.), Sta. 218 A, Admiralty Islands (603).

Pl. CXI.

f. 1–7. *Amphistegina lessoni* d'Orb.; figs. 1, 3 *c*, 5; Sta. 218 A, Admiralty Islands. fig. 2, Sta. 33, Bermudas. figs. 3 *a*, 3 *b*; Sta. 173 A, Fiji (9. 29. 82). figs 4, 7; Sta. 352, Cape Verde Islands. fig. 6, Sta. 172, Friendly Islands.

f. 8. *Cycloclypeus guembelianus* Brady, Sta. 174 c, Fiji (607).

Pl. CXII.

f. 1, 2. *Operculina ammonoides* (Gron.), Sta. 11, 'Porcupine,' W. of Ireland (10. 3. 47).

f. 3–5. *O. complanata* (Defr.); fig. 3, Sta. 195 A, off Amboyna (9. 29. 83). fig. 4, Sta. 218 A, Admiralty Islands. fig. 5, Sta. 172, Friendly Islands.

f. 6, 7. *O. complanata* var. *granulosa* Leym., Sta. 195 A, off Amboyna.

f. 8. *O. complanata* (Defr.), Sta. 195 A, off Amboyna (9. 29. 83).

f. 9, 10. *O. complanata* var. *granulosa* Leym.; fig. 9, Sta. 186, Flinder's Passage (604). fig. 10, Sta. 218 A, Admiralty Islands.

f. 11–13. *Nummulites cummingii* Carp.; fig. 11, Chinese Sea, dredged. figs. 12, 13; Sta. 218 A, Admiralty Islands (2. 29. 85).
f. 14–18. *Heterostegina depressa* d'Orb.; fig. 14, Sta. 219 A, Admiralty Islands. fig. 15, Sta. 260, Honolulu, fig. 16, Sta. 172, Friendly Islands (9. 29. 84). figs. 17, 18; Sta. 279 A, Tahiti.
f. 19, 20. *H.* sp., Sta. 260 A, Honolulu.

Pl. CXIII.

f. 1. *Textularia conica* d'Orb., Sta. 205 A, Hongkong.
f. 2. *T. crispata* Brady, Sta. 185, Torres Strait (Cambridge) & (179).
f. 3–5. *T. transversaria* Brady, Sta. 185, Torres Strait, fig. 4 (180).
f. 6. *Bulimina convoluta* Will., Sta. 185, Torres Strait (237).
f. 7. *Bolivina lobata* var. *strigosa* Brady, Sta. 185, Torres Strait (259).
f. 8. *Cassidulina calabra* (Seguenza), Sta. 185, Torres Strait (265).
f. 9. *Orthoplecta clavata* Brady, Sta. 219 A, Admiralty Islands (9. 29. 43).
f. 10. *Ehrenbergina pupa* (d'Orb.), Sta. 305, W. Coast of Patagonia.
f. 11. *Cristellaria latifrons* Brady, Sta. 166, W. Coast of New Zealand.
f. 12. *C. dentata* Karrer, Sta 174 c, Fiji, fig. 12 *a* (397).
f. 13. *Amphicoryne* sp., Sta. 174 c, Fiji (422).
f. 14. *Sagrina limbata* Brady, Sta. 185, Torres Strait (467).
f. 15. *Miliolina scrobiculata* Brady, shore-sand, Tamatavé, Madagascar.
f. 16. *M. pygmæa* (Reuss), Sta. 218 A, Admiralty Islands (42).
f. 17. *M. ferussacii* (d'Orb.), Sta. 185, Torres Strait (57).
f. 18, 19. *Cornuspira striolata* Brady, Sta. 8, 'Knight Errant,' Faroe Channel.
f. 20. *C. crassisepta* Brady, Sta. 7, 'Knight Errant,' Faroe Channel.
f. 21. *C. lacunosa* Brady, Sta. 185, Torres Strait (85).

Pl. CXIV.

f. 1. *Miliolina terquemiana* Brady, shore-sand, Tamatavé, Madagascar.
f. 2. *M. bertheliniana* Brady, Tamatavé, Madagascar.
f. 3. *M. bucculenta* Brady, Sta. 57, 'Porcupine,' Faroe Channel.
f. 4–7. *Planispirina communis* Seguenza; figs. 4, 5, 7; 'Lightning,' off Faröe, 170 fathoms. fig. 6, 'Porcupine,' 170 fathoms, Faröe Islands.
f. 8. *Lagena lævigata* (Reuss), Sta. (?), 'Challenger' (311).
f. 9. *L. spiralis* Brady, Sta. 185, Torres Strait (303).
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f. 11. *L. quadrangularis* Brady, Sta. 185, Torres Strait (329).
f. 12. *Frondicularia archiaciana* d'Orb., Sta. 185, Torres Strait (379).
f. 13. *Vaginulina legumen* (Linné) var. *arquata* Brady, Sta. 24, West Indies (9. 29. 53).
f. 14. *Cristellaria wetherelli* (R. Jones), Sta. 185, Torres Strait (392).
f. 15, 16. *C. compressa* d'Orb., Sta. 7, 'Knight Errant,' Faröe Channel.
f. 17. *C. acutauricularis* (F. & M.), Sta. 185, Torres Strait (Cambridge) & (402).
f. 18. *Sagrina nodosa* P. & J., Sta. 142, S. Africa (463).
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Pl. CXV.

f. 1. *Pulvinulina schreibersii* (d'Orb.), Sta. 185, Torres Strait (574).
f. 2. *P. vermiculata* (d'Orb.), Cagliari Sardinia, shallow water.
f. 3. *P. dispansa* Brady, Madeira (dredged).
f. 4, 5. *Truncatulina lobatula* (W. & J.), Sta. 78, S.E. of Azores.
f. 6. *Rotalia orbicularis* d'Orb., Sta. 142, S. Africa (582).
f. 7. *R. shroeteriana* P. & J., Chinese Sea, dredged.
f. 8. *R. pulchella* (d'Orb.), Straits of Banca.
f. 9. *Nonionina boueana* var. *armata* Brady, shore-sand, Tamatavó, E. coast of Madagascar (10. 3. 108).

TEXT-FIGURES.

f. 4. *Miliolina rupertiana* Brady, Tamatavó, E. coast of Madagascar.
f. 5 *b*. *Planispirina exigua* Brady, no locality.
f. 5 *c*. *P. sigmoidea* Brady, Sta. 120, off Pernambuco.
f. 8 *c*, *d*. *Keramosphæra murrayi* Brady, Sta. 157, Southern Ocean.
f. 12. *Lagena hertwigiana* Brady, Sta. 155, Southern Ocean.
f. 15. *Nodosaria intercellularis* Brady, Sta. 33. Bermudas.
f. 22. *Nummulites cummingii* Carp., Chinese Sea, dredged.

XXII.—*Heteromera of the Third Mt. Everest Expedition, 1924.* By K. G. Blair, B.Sc., F.E.S.

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The advantage to entomological science of having an experienced collector on the personnel of an expedition through little-known country, particularly such a faunistically interesting country as that traversed by the successive Mount Everest Expeditions, is abundantly illustrated by the results obtained on this third endeavour, so tragically near success, to conquer this hitherto impregnable mountain. Major R. W. G. Hingston was already known as an observant and competent naturalist, one, moreover, possessing the ability, a power that unfortunately does not always accompany sound scientific attainments, of imparting his observations to a wide circle of readers; his descriptions of insect and other life at these altitudes have already drawn attention to the great interest of the subject.

The present paper deals with nearly thirty species of Heteromera, compared with seven of the preceding expedition, or ten of the two previous expeditions together. Of these ten, one only, *Ceniopinus semicoccineus*, obtained on the 1921 expedition, was not obtained by Major Hingston.

Not only were insects collected in the vicinity of the base-camp as before, but from numerous localities, as opportunity offered, on both the outward and return journeys. In this paper only those from within the Tibetan border are dealt with, although collections, richer in point of numbers but of a more ordinary North Indian character, were made at lower altitudes (3000–7000 feet) before leaving Sikkim. This division is not entirely arbitrary, for the material collected from Tibet is, in fact, almost entirely different from that collected in Sikkim. That this difference is due, however, not to geographical boundaries but to altitude is evident when we find that the species from lower elevations in Tibet, *i. e.* up to about 12,000 feet, have more affinity with the fauna of moderate elevations in Sikkim than with the high mountain fauna, while many of the species obtained from high altitudes in Tibet have been found by other collectors at similar altitudes in Sikkim.

Family Tenebrionidæ.

1. *Ascelosodis nitida*, Blair, Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 281, note †.

Tibet: Shiling, 14,000 ft., 5. v. 24; Chumbab, 14,000 ft., 6. v. 24; Chiblung, 14,500 ft., 12. vii. 24.

Originally obtained from Sikkim in 1904, but not found by either of the preceding Everest expeditions.

2. *Ascelosodis everestina*, Blair, *loc. cit.* p. 278.

Tibet: Tuna, 14,500 ft., 11. v.; Kampa Dzong, 14,500 ft., 30. iv.; Tinki Dzong, 15,000 ft., 2. v.; Pang La, 17,000 ft., 9. v.; Rongbuk, 16,500–17,000 ft., 25–31. v.; Lamna La, 15,000 ft., 17. vi.; Tingri, 15,000 ft., 4. vii.

Sikkim: Deutang, 14,500 ft., 28. iv.

Described from material collected by Dr. Longstaff, 1922, at Rongbuk.

3. *Ascelosodis longstaffi*, Blair, *loc. cit.*

Tibet: Rongbuk, 15,000 ft., 15. vi.; 16,500 ft., 29–30. v.; Lamna La, 17,000 ft., 17. vi.; Tingri, 15,000 ft., 4. vii.; Tinki Dzong, 15,000 ft., 13. vii.

Also collected on the 1922 Expedition.

4. *Gnaptorina brucei*, Blair, *loc. cit.* p. 282.

Tibet: Tuna, 14,500 ft., 11. iv.; Kampa Dzong, 14,500 ft.,

28. iv.; Rongbuk, 15,000 ft., 16. vi.; Rongshar Valley, Tassam, 12,000 ft., 20. vi.; 15,000 ft., 2. vii.; Tingri, 15,000 ft., 4. vii.; Jikkyop, 14,500 ft., 11. vii.; Tinki Dzong, 15,000 ft., 13. vii., and Phari, 14,000 ft., 21. vii.

The types were taken on the previous expedition at Tengkye-La, 16,000 ft.

5. *Blaps thibetana*, Blair, *op. cit.* (9) ix. 1922, p. 559.

Tibet: Tinki Dzong, 14,000–15,000 ft., 13–14. vii.

Previously collected on the first Everest expedition, 1921; also from Gyangtse, 13,000 ft. (*H. J. Walton*).

6. *Blaps apicecostata*, Blair, *loc. cit.*

Tibet: Tuna, 14,500 ft., 9. iv.; Tropde, 11,000 ft., 23. vi.; Rongshaw Valley, 10,000 ft., 24. vi.; 15,000 ft., 2. vii.; Chumbi Valley, 10,000 ft., 7. vii.; Shekkar, 14,500 ft., 8. vii.; Phari, 14,000 ft., 21. vii.

Single examples from each locality. This species was also found on the 1921 expedition, at Gyangtse, 13,000 ft. (1904), and at Tungu, Sikkim, in 1903.

7. *Blaps himalaica*, Blair, *op. cit.* (9) xi. 1923, p. 283.

Tibet: Kampa Dzong, 15,000 ft., 17. vii.; Phari, 16,000 ft., 19. vii.

The short series of six specimens exhibits considerable variation in the strength of the punctures of the thorax and of the asperities of the elytra. Described from material collected by Dr. T. G. Longstaff in 1922.

8. *Blaps mærens*, Allard, Ann. Soc. Ent. France, (5) x. 1880, p. 319.

Tibet: Tinki Dzong, 14,000 ft., 14. vii.

The single specimen secured, a ♀, is considerably larger than normal, viz. 25 mm. in length, but does not appear to differ otherwise. A very similar specimen was taken at Chaksam, Brahmaputra Valley, 12,000 ft., in July 1904, by H. J. Walton. Not previously found by either Everest expedition.

9. *Blaps subcarinata*, sp. n.

Small, rather slender, nitid, piceous-black, legs reddish, dorsum rather feebly convex. Head moderately densely

punctate, clypeal suture arcuate, sharply impressed in middle, sides of clypeus nearly parallel, antennæ slender, reaching base of thorax. Thorax about half as wide again as long, widest about or a little before the middle, sides rounded, more strongly in front than behind, posterior angles obtuse; disc evenly convex from side to side, rather finely, not very densely, punctate. Elytra ovate, not produced at apex, lateral margins visible only at shoulders, each with seven low rounded costæ, the 1st sutural, the 7th arising at the shoulder and forming the lateral margin when viewed from above ; between the costæ is a double row of fine punctures, which, however, are not quite regular and from time to time combine to form a single row ; the 7th (marginal) costa is bounded externally by a single row of punctures, with a partial single row on the lateral declivity halfway between it and the lateral carina. Legs rather slender, reddish piceous, with black tarsi ; anterior femora somewhat clavate, the tibiæ correspondingly arcuate ; posterior tarsi slender, nitid, scarcely punctate, almost as long as the tibæ.

♂ more slender than the ♀, without ventral hair-pad, apex of elytra vertical, in the ♀ the apex is concealed from above by the bulging declivity.

Length 13 mm.

Habitat. Tibet : Jelap La, 12,000 ft., 1. iv.

This species would come into Abt. ii. Gr. 16 of Seidlitz's classification, but differs from all other members of the group in the peculiar elytral sculpture, which recalls that of *B. sulcata*, F., except that the costæ are rather less evident, very much wider than the intervals, and the whole surface nitid and, except for the paired rows, almost free from punctures. The reddish legs and the reddish tint perceptible particularly in the thorax, which colour does not appear to be due to immaturity, are very unusual in the genus.

10. *Platyscelis* (*Leipopleura*) *ænescens*, Blair, Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 284.

Sikkim : Deutang, 15,000 ft., 27. iv.

Tibet : Rongbuk, 15,000–16,500 ft., 22. v.–16. vi. ; Kyetrak, 15,000 ft., 18. vi. ; Rongshar Valley, 12,000 ft., 20. vi. ; Phari, 16,000 ft., 19. vii.

Also taken in some numbers on the preceding expedition.

STENILLUS, gen. nov. (*Stenosinæ*).

Head oval, somewhat narrowed behind the eyes, the latter completely divided by the canthus, clypeus depressed in front, truncate at apex. Antennæ slender, gradually thickened towards apex, 3rd joint as long as the two following together, 5th to 11th about as long as wide. Thorax strongly carinate at sides, without median depression. Elytra much wider at base than base of thorax, shoulders pronounced, but not dentiform, 7th interstice a little carinate in front to humeral angle ; epipleura continuous to apex, bounded within by a prominent carina.

Near *Dichillus*, J. du Val, from which it differs in the slender antennæ and prominent shoulders to the elytra. From *Pseudethas*, Fairm. (=*Dischizillus*, Wasm.), which has similar elytral shoulders, it differs in the head being gradually narrowed behind, the slender antennæ, and the lack of a median sulcus on the thorax.

11. *Stenillus monticola*, sp. n.

Brownish piceous, with a rather sparse decumbent pubescence. Head shortly ovate, convex between the eyes, clypeus rather produced and deflexed, slightly wider at apex than half the distance between the eyes, ocular ridges feeble ; antennæ reaching a little beyond middle of thorax, 3rd joint half as long again as 4th, the latter a little longer than wide, 4th to 8th successively shorter, the latter slightly transverse, 9th to 11th longer but thicker, a little compressed, the latter oblique at apex. Thorax widest in front, sides almost parallel in anterior third, thence feebly convergent to base, all angles rectangular; convexity of disc not extending to sides, convex portion rather densely punctate, the depressed lateral areas with very fine punctures, lateral margin slightly raised, base widely arcuate. Elytra elongate elliptical, shoulders angular, projecting beyond base of thorax, striæ rather strongly, evenly, not closely punctate, intervals somewhat convex with scattered microgranules, each with a median row of backwardly directed flavous setæ ; sutural intervals at apex rather strongly raised.

Length 4 mm.

Tibet : Chusar, 13,500 ft., 3. v. A single specimen.

LÆNA, Latr.

This is one of the characteristic genera of the mountainous region of Northern India and Central Asia, and, like other groups of apterous beetles in other parts of the world, has here evolved a large number of closely allied species, many of which are restricted to the one valley system. These Himalayan species have already been the subject of long study by Prof. Adrian Schuster of Vienna, and it was deemed advisable that the material brought back by Major Hingston should be submitted to this eminent specialist for determination. The results of his work appear in the form of a complete revision of the known *Læna* species of these regions, as yet forty-six in number, in the 'Koleopterologische Rundschau,' Band 12, 1926, pp. 31–54. Five of the following six species obtained by the Expedition are there described as new.

12. *Læna parallelocollis*, Schust. *loc. cit.* p. 40.

Tibet: Kampa Dzong, 15,000 ft., 17. vii. 24. A single ♂.
Allied to *L. tibetana*, Schust., but distinct in its transverse subrectangular prothorax.

13. *Læna alticola*, Blair, Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 284.

Tibet: Rongbuk, 16,500 ft., 29. v. Six specimens.
This species was taken in some numbers in the same vicinity by Dr. T. G. Longstaff on the expedition of 1922.

14. *Læna hingstoni*, Schust. *loc. cit.* p. 42.

Tibet: Jelap La, 12,000 ft., 1. iv. A single ♂.
Allied to *L. nigritissima*, Rtt., but having the thorax finely instead of coarsely punctured.

15. *Læna gracilis*, Schust. *loc. cit.* p. 46.

Tibet: Jelap La, 12,000 ft., 1. iv. A single example.
Distinguished by its small size, sharply-toothed femora, and the sides of the thorax immarginate.

16. *Læna ænea*, Schust. *loc. cit.* p. 49.

North India: Darjeeling, 7000 ft., 11–20. iii. A single example.

Although this species does not come from within the Tibetan frontier it is included here for the sake of completeness.

17. *Læna cylindrica*, Schust. *loc. cit.* p. 52.

Tibet: Yatung, 10,000 ft., 17. iv. A single example.

Allied to *L. gracilis*, but larger, blacker, with the thorax much more finely and sparsely punctate, and the elytra hairless.

These species may be briefly differentiated by means of the following key (adapted from that of Schuster):—

1 (8).	Thorax bordered at sides; femora not toothed.	
2 (7).	Elytra sparsely setose; intervals with a median row of punctures.	
3 (6).	Elytral setæ short, little evident.	
4 (5).	Sides of thorax straight in middle, puncturation fine and sparse; punctures of elytral striæ uneven, larger in front, rather widely spaced. Long. 5 mm.	*parallelocollis*, Schust.
5 (4).	Thorax rounded at sides, puncturation close and coarser; elytral striæ evenly and closely punctate. Long. 6–7 mm.	*alticola*, Blr.
6 (3).	Elytra with long erect hairs. Long. 6·5 mm.	*hingstoni*, Schust.
7 (2).	Elytra not setose, intervals without row of punctures. Long. 5 mm. ..	*ænea*, Schust.
8 (1).	Thorax not bordered at sides; femora toothed.	
9 (10).	Upper surface clothed with erect hairs; thorax irregularly but strongly punctate; elytral intervals with a row of distinct punctures smaller than those of the striæ. Long. 3·5 mm.	*gracilis*, Schust.
10 (9).	Upper surface glabrous; thorax more finely and sparsely punctate; punctures of elytral intervals very fine. Long. 5 mm.	*cylindrica*, Schust.

Three Tenebrionid larvæ belonging to the subfamily Blaptinæ were also collected under stones at the E. Base Camp, Rongbuk, 16,500 ft., 15. v. 24. No mature beetles appear to have been collected with them, but, in view of the small size of the larvæ and the comparative abundance of *Gnaptorina brucei* in the vicinity, the probability is that they may be assigned to this species.

Length (dry) 12–14 mm.

Yellowish testaceous with the greater part of the head posteriorly, of the prothorax anteriorly, and a posterior border on each of the following segments except the last piceous. Abdominal segments approximately equal in length, the last subconical, with dorsal surface depressed, and slightly curved upwards towards the apex, the tip not produced, each side with a row of six or seven strong erect spines, the three near the tip close together, the others at greater intervals ; the ventral side is sparsely set with long erect hairs, those towards the sides being well visible from above. The larva is evidently very closely related to *Blaps*, but differs from that of any species known to me in its banded coloration, and in the tip of the last abdominal segment not being produced. There is also behind each antenna a transversely elongated pigment-spot that may function as an ocellus, though the cuticle of the head-capsule does not appear to be differentiated from that around it. The powerful anterior pairs of legs is armed with stout spines similarly disposed to those of *Blaps*, viz. two on the inner side of the trochanter a little before the tip and four around the short curved inner side of the femur ; the tibia bears two or three longer, more slender bristles along the apical half of its inner edge.

Fam. **Cistelidæ.**

18. *Allecula himalaica*, sp. n.

Elongate-elliptical, ferruginous brown, with antennæ and legs a little paler, pubescence rather long, subdecumbent, golden-brown. Head short, rapidly narrowed in front, labrum wider than the clypeus; frons rather densely and coarsely but not sharply punctate, punctures becoming less dense towards sides and on clypeus ; distance between eyes about equal to width in front of clypeus, similar in both sexes, antennæ slender, joints 3 to 11 subequal in length ; last joint of maxillary palpi transverse, inner side about equal to outer, but upper face much shorter than lower. Thorax transverse, widest at base, sides rather sinuately narrowed forwards, merging gradually into the arcuate anterior margin, median length little more than half width across base, base strongly bisinuate, finely bordered, disc densely and coarsely punctate, but punctures shallow and umbilicate. Elytra at base not wider than thorax but at once widened, striæ sharply impressed, not very closely punctured, 1st and 9th uniting at apex, the others usually failing to meet, 4th and 5th shortest; intervals convex,

asperately but not closely punctate. Legs slender, posterior femora somewhat thickened, posterior tarsi very slender, first joint longer than the rest together.

♂. Antennæ more slender, last ventral segment with a wide depression, its limiting carinæ approximate near base, where they are almost parallel for a short distance.

Length 7 mm.

Tropde, 11,000 ft., 22. vi.; Rongshar Valley, 11,000 ft., 27. vi. (type); Yatung, 10,000 ft., 23. vii.

Closely resembles *A. tenuis*, Mars., from Japan, but with broader shorter thorax, less strongly transverse apical joint to the palpi, the inner edge of which is not longer than the outer.

19. *Allecula seminitens*, sp. n.

Black, antennæ, palpi, tibiæ and tarsi reddish, underside blackish piceous. Head rather finely, not very closely punctate; eyes separated by a space nearly twice as wide as one of them. Thorax transverse, widest at the base, closely and rather coarsely punctate on the disc, the punctures more or less confluent; near the margins they become finer and more widely separated, so that the margins are obviously more nitid, this nitid border being widest towards the anterior angles. Elytra wider than the thorax, shining black, the striæ well defined, strongly and closely punctate, the punctures becoming smaller behind until near the apex the striæ appear deeply cut and impunctate; intervals slightly convex, finely and sparsely punctate, each puncture with a short depressed reddish hair.

Long. 9 mm.

Tropde, 11,000 ft., 22. vi.

A single ♀. Allied to the preceding and to *A. ellipsodes*, Fairm., and *squalescens*, Fairm., but very differently sculptured.

It is noteworthy that these two members of the Cistelidæ and many of the following species from comparatively low elevations in Tibet are really representative of the fauna of lower altitudes, like the bulk of the material collected in Sikkim, rather than of the high mountain fauna.

Fam. **Lagriidæ.**

20. ***Lagria tibetana***, sp. n.

Rather short, stout, widest before apex, black, with the elytra brown. Head and thorax densely punctate; distance

between eyes (♂) about one-third total width of head, antennæ rather slender, 3rd joint scarcely as long as 4th, half as long again as 5th, 5th to 10th gradually decreasing in length, the latter about as broad as long, 11th joint (♂) slightly longer than the two preceding together, subcylindrical, acuminate at tip. Thorax slightly wider than long, sides nearly straight, without lateral carina, anterior angles obsolete, disc convex from side to side, scarcely depressed in middle; pubescence directed transversely towards middle line, then backwards. Elytra coarsely and densely punctate with a tendency to confluence transversely, the intervals between punctures wider than on thorax causing them to appear more nitid, pubescence rather short, decumbent; lateral carina mostly visible from above, but concealed beneath humeral angle, epipleura terminated slightly before apex. Underside piceous, tip of abdomen testaceous.

♂ rather more slender than ♀, elytra less ampliated; antennæ very slightly longer, joints 6–10 each with a stout spine or tubercle beneath; on the 6th joint this is in the middle of the joint, but it successively approaches the apex, being nearly apical on the 10th.

Length 7–8 mm.

Tibet: Rongbuk Valley, 10,000–11,000 ft., 24–28. iv.

Resembles *L. bicolor*, K. & R. (= *ruficollis*, Borch., nec Hope), but the latter has much more slender antennæ with more elongate last joint, more irregular elytral puncturation without transverse confluence, and is differently coloured.

Fam. Pedilidæ.

21. *Eurygenius fulvopictus*, Champ. Ent. Mo. Mag. 1925, p. 109.

Rongshar Valley, 9500 ft., 24. vi.; Yatung, 10,000 ft., 23. vii.

Two examples, one from each locality, agree fairly well with Champion's type from N. Kumaon, though presenting certain differences in the maculation of the elytra. That from Rongshar is, perhaps, not fully mature, having browner elytra and femora more brightly red at base. The nearest ally of this species is *E. niponicus*, Lewis, which, however, is unspotted.

Fam. Mordellidæ.

22. *Anaspis* (*Silaria*) *everestina*, sp. n.

Black, with the mouth-parts, first three joints of antennæ

testaceous, and anterior legs fusco-testaceous. Antennæ thickened apically, no joints transverse.

♂ with anterior tibiæ thickened, straight on outer side, feebly sinuate internally, anterior tarsi about as long as the tibiæ, first three joints expanded, basal joint nearly as long as the next two together, the longer of the tibial spurs extending beyond the middle. Middle tibiæ slightly thickened towards tip, feebly sinuate with apex turned outwards ; first joint of posterior tarsi nearly as long as the tibia.

Length 3¼ mm.

Rongshar Valley, 11,000 ft., 27. vi.

A single ♂ differs from *A. tibialis*, Schils., from Kaschmir, in the form of the anterior tibiæ and the darker colour of the two posterior pairs of legs.

Fam. Anthicidæ.

23. *Anthicus crinitus*, Laf., var. *longipennis*, Desbr. Op. Ent. i. 1875, p. 45.

Anthicus communimacula, Fairm., Ann. Soc. Ent. Belg. xl. 1896, p. 47.

Rongshar Valley, 9500 ft., 25. vi.

A single specimen agrees well with Fairmaire's type from S. India, described from Mr. H. E. Andrewes's collection, now in the British Museum. The species seems to have a rather wide distribution from India to Siam.

24. *Anthicus hauseri*, Pic, Echange, xxii. 1906, p. 49 (?).

Tropde, 11,000 ft., 22. vi. ; Rongshar Valley, 10,000 ft., 24. vi.

Two individuals, in a poor state of preservation, are doubtfully assigned to this species, described from Kuku-Nor.

25. *Anthicus hingstoni*, sp. n. (von Krek. *in litt.*).

Black, with a slight æneous tinge ; antennæ, tibiæ, and tarsi testaceous ; elytra sometimes with a pale subapical band, more rarely with pale post-humeral spots ; pubescence decumbent, cinereous.

Head subparallel behind the eyes, posterior margin arcuate, moderately strongly punctate ; mouth-parts fuscous ; antennæ slender, all joints elongate, last joint about as long as the two preceding together, colour yellow, sometimes

rather obscure, with basal joints darker. Thorax very short, almost transverse, scarcely as wide as the head, and similarly punctate, disc convex without impressions, sides rather strongly narrowed behind, nearly straight behind the widest part. Elytra about twice as wide across shoulders as base of thorax, thence slightly widened to about two-thirds; surface regularly not very finely punctate, suture slightly impressed behind scutellum. Colour very variable, usually without pale markings, sometimes with a pale transverse band a little before apex, occasional post-humeral spots also present, which are sometimes connected along the suture with the subapical band. Legs usually testaceous with dark femora.

♂ with an oblique swelling or umbo in the apical angle of each elytron, the angle itself somewhat rounded so as to leave a small sutural excision. The development of pale coloration is usually more marked in this sex, the yellow even of the antennæ and legs being often very obscure in the ♀.

Length 3–4 mm.

Lamna La, 17,000 ft., 17. vi. (type); Shekkar, 14,500 ft., 9. vii.; Tinki Dzong, 14,000 ft., 14. vii.; under stones.

This interesting species, a noteworthy addition to the high mountain fauna, is allied to *A. informipes*, von Krek., but is more strongly punctate, and with very different sexual characters in the ♂. From *A. nectarinus*, Pz., it differs further in the much smaller eyes, the head less rounded behind, as well as in its darker colour, and differently coloured antennæ.

As the typical ♂ I have selected that with the pale markings best developed, considering the dark form, though more numerous, as a melanic variation of the type. This melanism appears to bear no definite relation to altitude, as a nearly black ♂ is from the same locality as the type, while the single ♀ from Lamna La is very similar to the palest from Shekkar.

Fam. **Meloidæ**.

26. *Mylabris macilenta*, Mars.

Tibet: Tropde, 12,000 ft., 21. vi.; Rongshar Valley, 12,000 ft., 29. vi.

Occurs all along the southern slopes of the Himalayas from Kashmir to Burmah, but apparently from moderate elevations only. A previous specimen labelled Tibet is in the British Museum, collected by T. Savage Landor, but neither altitude nor nearer locality is stated.

27. *Mylabris przewalskyi*, Dokht. Horæ Soc. Ent. Ross. xxi. 1887, p. 341; xxiv. 1890, pl. i. figs. 11, 12.

Mylabris goutelli, Fairm. Ann. Soc. Ent. France, (6) ix. 1889, p. 48; Compt. rend. Soc. Ent. Belg. 1891, p. xxiii.

Tibet: Rongbuk, 15,000 ft., 16. vi. (1 ex.); Tingri, 15,000 ft., 6. vii. (4 ex.); Tinki Dzong, 15,000 ft., 13. vii. (4 ex.); Ling Ka, 14,000 ft., 15. vii. (1 ex.). Also 1 ex. collected by Dr. Longstaff on the 1922 Expedition, and 6 ex. from Gyangtse collected on the Tibet Expedition of 1904.

This species, as previously reported by me in the results of the earlier expeditions of 1921 and 1922, I now consider to be an aggregation formed of three distinct species. That there was some such confusion had indeed occurred to me when working over the earlier material, but, in view of the small number of specimens before me and of their apparently occurring on the same ground, I preferred to consider them provisionally as all members of one variable species. The long series of 83 specimens now collected by Major Hingston from many localities now enables me, in spite of their occurrence together, to separate three species with some degree of confidence. Major Hingston informs me that these beetles are the commonest and most conspicuous insects on the plateau. They swarm in calm weather upon the vetches and irises, but when the wind begins to blow they all fall to the ground and sham dead.

I have already * stated my reasons for being unable to accept Dr. Creighton Wellman's provisional determination of this species as *Pseudabris tigriodera*, Fairm., and, without seeing the type, the same reasons still apply to all of the forms now considered. The synonymy of *M. goutelli*, Fairm., subsequently reported by its describer, with *M. przewalskyi*, Dokht., appears from the description to be perfectly correct.

The two new species now proposed are the following:—

28. *Mylabris longiventris*, sp. n.

Very similar to the foregoing, but differing as follows:— average size smaller, abdomen usually projecting beyond the tips of the elytra, third yellow band of elytra usually broken up into three or four spots, but when intact narrow and strongly zigzag, and sloping a little obliquely back wards, subapical yellow fascia represented by two strongly

* Ann. & Mag. Nat. Hist. (9) ix. 1922, p. 561.

oblique spots. In *M. przewalskyi* the third band is wide and transverse, its outlines irregular but not distinctly zigzag. In this species, too, all the yellow bands are sprinkled with large conspicuous black impressed spots to almost an equal degree, those of the basal band being sometimes smaller. In *longiventris* these impressed spots are almost lacking, or represented by fine impressions, marked or not with black, mainly on the second fascia.

Long. (to tip of elytra) 8–13 mm., with average about 10 mm.; for *M. przewalskyi* these measurements, in the material collected by Major Hingston, are 8–15 mm. (av. about 12).

These differences are not sexual, and the distinct form and direction of the third yellow band incline me to consider them of specific rather than of varietal value.

Tibet: Tingri, 6. vii. (7 ex.); Shekkar, 9. vii. (11 ex.); Kyishong, 10. vii. (5 ex.); Chiblung, 12. vii. (2 ex.); Tinki Dzong, 13. vii. (1 ex.). Also found by the Expedition of 1921 (1 ex.), and at Gyangtse, June 1904 (4 ex., *H. J. Walton*).

29. *Mylabris hingstoni*, sp. n.

Closely resembling the two preceding, but larger and more slender, antennæ longer, extending beyond base of thorax, elytra longer, almost covering the tip of the abdomen, body clothed with longer, more villose pubescence. The markings, as in the other two species, vary indefinitely in the relative development of black and yellow, and, also as in the others, the colour of the two basal bands is in some individuals distinctly red instead of yellow, but in others of the same colour as the two posterior bands. The third band slopes obliquely backwards as in *longiventris*, but though irregular and often broken into spots is not definitely zigzag. A constant feature seems to be that the outer margin is never interrupted by the yellow markings, but even when the black on the anterior half of the elytra is reduced almost to vanishing point a broad black border runs round beneath the shoulder. The black spots scattered over the yellow markings are sometimes large and uneven, but much less deeply impressed than in *M. przewalskyi*, in some cases small or even absent.

Long. 11–19 mm. (average about 16 mm.).

Tibet: Tingri, 6. vii. (12 ex.); Shekkar, 9. vii. (13 ex.); Kyishong, 10. vii. (4 ex.); Chiblung, 12. vii. (5 ex.); Tinki

Dzong, 13. vii. (4 ex.); Ling Ka, 14,000 ft., 15. vii. (3 ex.); Kampa Dzong, 15,000 ft., 17. vii. (6 ex.).

Also collected by the 1921 expedition (5 ex.) and from Khamba Jong (?=Kampa Dzong), 15–30. vii. 1903 (6 ex.).

A short series from Lhasa (viii.–ix. 04, 4 ex.) and Chaksam, 12,000 ft., vii. 04, collected by H. J. Walton, have the black bands of the elytra predominant even on the anterior portion of the elytra, but in other respects agree well with *M. hingstoni*; these may be known as var. *waltoni*, nov.

XXIII.—*Description of a Cricket supposed to present Termitophilous Habits.* By L. Chopard.

Eugryllodes * *pomeroyi*, sp. n.

Type: 1 ♀, Gold Coast, Accra (*A. W. J. Pomeroy*), 29. vi. 1926. In the British Museum.

Medium size, pale testaceous, pubescent. Head large, globular; skull orange-testaceous, with scarcely visible, fine, pale lines; frontal rostrum wide, presenting a brown spot above the anterior ocellus; face very convex; clypeus and mouth-parts orange-yellow; facial shield pale yellow, with brown spots along the antennal sockets and in the mandibular angle; cheeks pale yellow. Palpi nearly white, rather long and slender; third and fourth joints of maxillary palpi equal in length, fifth a little longer, feebly enlarged at apex. Antennæ brown, the first joint yellowish. Eyes rounded; ocelli rather large, disposed in a triangle, surrounded with white, the lateral ones united by a slender white line above the brown spot of the forehead.

Pronotum transverse, slightly widening in front, with anterior and posterior margins straight, furnished with brown

* I propose the new name *Eugryllodes* for those species of the genus *Gryllodes* which are pale testaceous in colour, presenting a rather wide head with forehead somewhat sloping, pronotum slightly flattened on the disk, more or less widening backwards. The tegmina are as long as abdomen, very wide, with complete tympanum in males; in females they are usually much reduced. The new genus includes the species of the fourth group of *Gryllodes* of Saussure and some others, viz.:—*G. pipiens*, Duf. (type of the genus *Eugryllodes*), *G. lateralis*, Fieb., *G. ochous*, Uv., *G. terrestris*, Sauss., *G. saltator*, Sauss., *G. cantans*, Sauss., *G. niloticus*, Sauss., *G. macropterus*, Fuente (*kerkennensis*, Finot, micropterous form), *G. patagonus*, Sauss. All these species are more or less deserticolous in habits.

bristles; disk slightly convex, pale testaceous, with a few brown spots and the two usual piriform impressions which are orange-yellow; lateral lobes nearly white, with inferior margin slightly darkened, weakly ascending backwards. Abdomen very light brown above, white beneath, covered with a silky pubescence; metanotum and first abdominal tergite presenting two small brown bands near the median line; subgenital plate small, rounded. Cerci long, light brown. Ovipositor rudimentary, completely concealed under

Fig. 1.

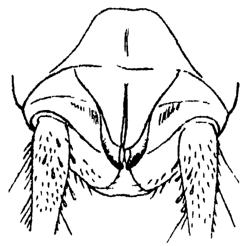


Fig. 2.

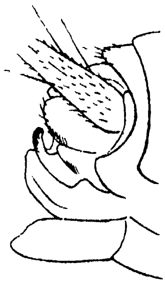
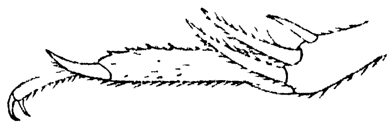


Fig. 3.

Fig. 4.



Eugryllodes pomeroyi, sp. n.

Fig. 1.—Apex of abdomen, ventral view, the subgenital plate being reversed to show the ovipositor.
Fig. 2.—Apex of abdomen, lateral view, the subgenital plate being removed to expose the ovipositor.
Fig. 3.—Apex of anterior tibia, with spurs and tarsus.
Fig. 4.—Internal face of apex of posterior tibia and tarsus.

the genital plate; superior valves weakly chitinized and darkened at apex, but presenting no trace of the apical parts, inferior valves completely membranous, internal ones reduced to very small tubercles.

Legs whitish, pubescent, bearing a few long brown bristles. Anterior tibiæ perforated on their external face with a rather large oval tympanum; apical spurs long, three in number, almost equal in length and removed towards the inferior edge;

tarsi rather long but somewhat thick, the metatarsus a little longer than the other two joints together. Median tibiæ with four apical spurs, the two external being shorter than the two internal ones. Posterior femora rather thick, presenting a few brown stripes on their external face; tibiæ whitish, with spines and spurs yellow; five internal, six external spines; apical spurs long, the two large internal ones equal in length, the infero-external a little longer than the infero-internal one; metatarsi thick, grooved above, with seven denticles on each margin.

Elytra lateral, widely separated along the median line, their internal margin oblique, a little sinuated; dorsal field brown, with feebly projecting, shining veins; these are a little irregular, five in number; lateral field high, whitish, nearly transparent, the mediastinal vein brown, furcate at apex, and four other veins, regularly distant, very pale coloured. Wings extremely reduced, concealed under the tegmina.

Length of body 13 mm.; pronot. 2·5 mm.; post. fem. 8·5 mm.; post. tib. 5·5 mm.; elytra 2 mm.

An immature male which was found with the typical female shows well-developed elytral and alar pads; very probably the adult male possesses much longer elytra than the female.

This species seems very close to *E.* (*Gryllodes*) *saltator*, Sauss., from Bar-el-Abiad, but the latter having been described on an immature male only, it is quite impossible to make a useful comparison of the two species. The main feature of the present species is the abnormal reduction of the ovipositor, which is much more reduced than in the genus *Anurogryllus* itself. In that genus the ovipositor is completely chitinized, and its valves show a well-defined apical part. In *E. pomeroyi* the ovipositor is not exactly of a larval type, although very feebly chitinized, as its valves present a different degree of regression, the internal one being almost completely aborted, the superior ones, on the contrary, being somewhat chitinized. In a larval stage, when the ovipositor is about as long as it is in the adult *E. pomeroyi*, the inferior and superior valves would be equally membranous and of the same length, whereas the internal ones would be comparatively longer. As a whole, the ovipositor of *E. pomeroyi* shows regression rather than incomplete development.

This interesting species has been found by Mr. A. W. J. Pomeroy with termites, but the collector does not say whether the cricket was found with living termites or simply in the galleries of a termite-mound. It is therefore very difficult

to state whether it is termitophilous or not, as a considerable number of insects that have been found in termite-mounds are simply accidental guests. The only features which could be regarded as the result of termitophilous habits are the very pale colour and the absence of the ovipositor. The first character is, as we have stated, a generic character, all the species of the group being pale testaceous; as to the second, not only is it contradictory to what is usually observed in termitophilous insects, but it seems also to be a tendency of the group, as is clearly shown by *E.* (*Gryllodes*) *escalerai*, Bol., from Spain, which has an unusually short ovipositor. As is often the case with highly specialized insects, a serious study of the allied species shows that the specialization is simply the exaggeration of a general character of the group to which they belong.

XXIV.—*The Red Sponges of Monterey Peninsula, California**. By M. W. DE LAUBENFELS, Hopkins Marine Station, California.

ALL authorities on the siliceous sponges agree in dividing them into two sharply marked groups, of which one (usually called the Hexactinellida) is characterised by triaxon spicules. In California we have a sponge obviously belonging to the other group (usually called Desmospongiæ), yet which has triaxon—that is to say, pentactine—spicules. This may necessitate some revision of our concepts as to the interrelationships of the siliceous sponges.

Let us first give a formal description of the species in question, and then proceed with a few remarks as to the matters of interest involved.

Acarnus erithacus, sp. n.

Loc. Monterey Peninsula and also White's Point, near Los Angeles, in southern California. Not common.

Hab. Near low-tide mark.

* Monterey Peninsula forms the southern shore of Monterey Bay, California, latitude 36° 36′ North, longitude 121° 55′ West. The water of the Pacific is here very cold, often as low as 10° C., and seldom rising above 15° C. even in summer. The shore is rugged, the rock is granite, and there are many rocky beaches covered by surf at high tide, but showing a strip of seaweed-covered boulders at low tide. These large stones are profusely encrusted with red sponges, which are the forms discussed in this article.

Shape. Encrusting.

Size. Up to 2·5 cm. thick.

Colour. Bright red in life, dull pale brown in preservatives.

Consistency. Between firm and fragile.

Surface appearance. Compound hispid, the optically evident protrusions being secondarily hispid as viewed with a lens, due to echinating spicules.

Pores. Abundant, minute.

Oscula. One for each 7 square cm. Diameter 4 mm. Sometimes flush, occasionally with slightly raised collars.

Ectosome. From the surface to a depth of 1·5 mm. the red colour is most brilliant. At this depth there is in some specimens a sharply marked plane, parallel to the surface, filled with minute green cells that are presumably symbiotic algæ. Below this point the colour is paler.

Parenchyma. There is a jelly-like ground-mass permeated by spiculo-fibres, filled with loose spicules, and greatly eroded by canals and gross chambers up to 1 mm. in diameter.

Skeleton. (1) Styles, smooth, varying from $0{\cdot}01 \times 0{\cdot}2$ to $0{\cdot}015 \times 0{\cdot}33$ mm. These both core and echinate the ascending fibres and are the most evident skeletal element.

(2) Tylotes, smooth, varying from $0{\cdot}005 \times 0{\cdot}18$ to $0{\cdot}007 \times 0{\cdot}17$ mm. These form the secondary connectives between the ascending fibres near the surface of the sponge.

(3) "Palm trees" (Cladostrongyles ?) $0{\cdot}008 \times 0{\cdot}18$ mm., chords 0·036 mm. These form the secondary connectives between the ascending fibres in the lower parts of the sponge. They have exactly four cladi each 90° from its neighbours, making one end of this spicule a perfect anatetræne. The opposite end is what some would term "enormispinulate," due to four rounded protusions each in the same plane with one of the cladi at the other end. These exactly resemble the protusions left on the shaft of a reduced hexactinellid (hexactine) spicule.

(4) "Rose stems" (Acanthocladostrongyles) $0{\cdot}004 \times 0{\cdot}08$ mm. These project into the larger canals, cladi out, at right angles to the walls of the canals. They are much like the peculiar spicules found in other species of *Acarnus*, but have uniformly four recurved spines on the tylote end and four shorter curved spines pointing the same direction at the other end, each of them in the same plane with one of the cladi; this end is a protetræne. The shaft is studded with curved spines, all directed as are the cladi at the ends; they resemble rose-thorns.

(5) Toxas, abundant, with great variation in size, *i. e.*, from 0·045 to 0·2 mm. in length.

(6) Palmate isochelas, abundant, 0·012 to 0·016 mm. in length.

The genus *Acarnus* was founded by Gray in 1867 * for a spicule-drawing by Bowerbank, with the diagnosis "Sponge reticulate. Spicules: 1. Cylindrical, fasciculated. 2. Cylindrical, forming radiating groups, with stellate four-rayed ends, rays short, recurved."

Ridley, in 1884 †, described *A. ternatus* with cladostrongyles in groups of three. This species is recorded from Tahiti, Bombay, Torres Strait, and the Amirante Islands.

Topsent, in 1892 ‡, described *A. tortilis* from the Mediterranean coast of France, later found also at the Azores.

Dendy, in 1896 §, described *A. tenuis* from Australia, and in 1921 ‖ described *A. topsenti* from the Indian Ocean. *Tenuis* had no chelas, and *topsenti* is a digitate form.

A. erithacus is unique in the type of its "palm-tree" spicule, and also differs in minor respects from the other species. The closest is probably *A. tortilis*, which is an encrusting form much like the Californian sponge, but without the "palm-trees," and having its other megascleres approximately double the size of those in *A. erithacus*. Mons. Topsent collected it himself, and says nothing of any bright red colour in life.

Full appreciation of the possible significance of this remarkable spiculation can be obtained by studying a series of hexactinellid spicules, and then studying *A. erithacus*. The pinulus is a typical hexactinellid spicule; if its four shorter rays are recurved a little the result would be a counterpart of the "rose-stem" spicule. The rather common four-toothed amphidisc, which is reduced from a many-toothed amphidisc, if reduced but a little further would be the tridentate chela so typical of the Demospongiæ. Many-toothed amphidiscs are also found in numerous monaxonid sponges. The clavulas of hexactinellids are in some cases exact reproductions of the "palm-tree" spicules. It is interesting to note spicules of this type in a monaxonid sponge rather far removed from *A. erithacus*, namely, in *Protelia sollasi*, Dendy & Ridley, 1886 ¶. The spicules of

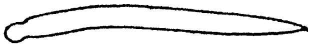
* Proc. Zool. Soc. London, 1867, p. 492.
† Zool. Collections H.M.S. 'Alert,' p. 453.
‡ Arch. Zool. Exp. et Gen. 1892, (2) pp. xvii–xxviii.
§ Proc. Roy. Soc. Victoria, vol. ix.
‖ Trans. Linn. Soc. London, Zool. ser. 2, vol. xviii.
¶ Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. p. 153.

1. Palmate isochelas, found in all four species. (× 600.)

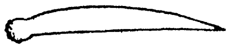
2. Toxas, found in all four species. (× 600.)

3. Rhaphides, found in *Ophalitaspongia* and both *Plocamias*. (× 300.)

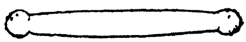
4. Style, as found in *Ophalitaspongia*. (× 300.)



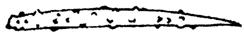
5. Style, as found in *Plocamia karykinos*. (× 300.)



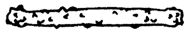
6. Tylote, as found in *Plocamia karykinos*. (× 300.)



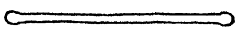
7. Acanthostyle, as found in *Plocamia lithophœnix*. (× 300.)



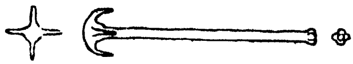
8. Acanthotylote, as found in *Plocamia lithophœnix*. (× 300.)



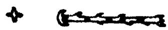
9. Tylote, as found in *Acarnus erithacus*. (× 300.)



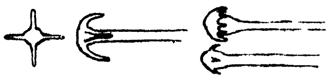
10. "Palm Tree" spicule of *Acarnus erithacus*. (× 300.)



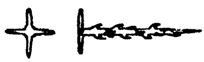
11. "Rose Stem" spicule of *Acarnus erithacus*. (× 300.)



12. Various forms of the clavula, a common spicule in Hexactinellids.



13. Various forms of the pinulus, a common spicule in Hexactinellids.



14. A four-toothed amphidisc, as found in some Hexactinellids.

15. Anchorate isochela, a common spicule in Monaxonellid sponges.

16. Many-toothed amphidisc, common in many Hexactinellid sponges.

17. Many-toothed amphidisc or birotulate of some Monaxonellid sponges (i. e., *Dosilia palmeri*, Potts).

A. erithacus resemble those of hexactinellids far more than they resemble those of textraxonid sponges. I think this is not mere accident, but indicative of relationship.

There is no doubt but that some of the monaxons are simplified from tetraxons. The common assumption is that therefore all are, but this does not necessarily follow. Let me call attention to a very fundamental structural character, not often stressed, yet offering a strong clue as to the relationships of the *Porifera* :—

(1) We have a group of sponges comprising all the tetraxonid genera in the old sense, and some of the monaxons such as *Donatia*, *Spirastrella*, etc., even perhaps some species of *Halichondria*, in which there is no end-to-end linkage of spicules. If the sponge uses keratose or other horny connective tissue, it is to join spicules side-to-side.

(2) We have a group of sponges comprising all the hexactinellid genera proper, and many of the monaxons, such as *Reniera*, *Chalina*, *Mycale*, *Myxilla*, etc., in which there is conspicuous end-to-end linkage of spicules. This linkage is usually by means of keratin, but may even be by siliceous material as in the dictyonine sponges. One of the Keratosa or horny sponges (*Darwinella*) has hexactine horny spicules ; all the keratose sponges probably belong here.

I personally believe that there is a natural cleavage of the non-calcareous sponges into the two groups outlined above, which might be called respectively Tetraxonida and Desmacidonida.

Plocamia karykinos, sp. n.

Loc. Monterey Peninsula, abundant.

Hab. From half-tide to low tide, usually on vertical faces of granite.

Shape. Encrusting.

Size. Up to 4 or 5 cm. thick.

Colour. Bright red in life, dull light brown in preservative.

Consistency. Firm, woody. In dying it produces large quantities of colourless slime not evident in life. No other local sponge gives off so much.

Surface appearance. Hispid.

Oscula. Approximately one per square cm., 1 to 2 mm. in diameter, and sometimes with slightly raised collars.

Pores. Approximately one per square mm., diameter when fully open 0·18 mm.

Ectosome. No specialisation.

Parenchyma. Ascending fibres densely cored and echinated

by spicules and connected by secondary fibres at right angles to the main tracts. The upper ends of the ascending fibres project and render the surface hispid.

Skeleton. (1) Abundant tylotes, heads minutely spined, size 0·02×0·18 mm. These core both the ascending and secondary (horizontal) fibres.

(2) Tylostyles, heads minutely spined, size 0·02× 0·165 mm. These echinate the ascending fibres.

(3) Raphides or slender tylostyles, scattered, varying greatly in size, but often about 0·003×0·17 mm. These seem to be young forms of the larger spicules.

(4) Toxas, not common, length 0·045 mm.

(5) Palmate isochelas, rare, length 0·015 mm.

This species differs considerably from most others of its genus—in fact, *Plocamia* might be subdivided into several genera were criteria applied to it as sharply as they are applied to some larger genera. Its closest relatives are *P. manaarense*, Carter, 1880*, from India, and *P. novizelanicam*, Ridley, 1881 †, from New Zealand. Both of these, however, are *Gorgonia*-like in architecture, the former has an isodictyal structure, the latter has its tylotes entirely spined, and both have very large smooth styles quite unlike any in our local form.

There is in the United States National Museum a small fragment of a sponge with no more definite locality-record than from "the Coast of California," which L. M. Lambe identified as *P. manaarense*. It certainly is not the Indian sponge, but there is not enough of it to be sure if it is *P. karykinos* or some other *Plocamia*.

Plocamia lithophœnix, sp. n.

Loc. Monterey Peninsula, abundant.

Hab. From half-tide to at least a few feet below low tide. This competes for space with the preceding form, a colony of the one sometimes overlapping an encrustation of the other when their edges meet.

Shape. Encrusting, noticeably more lumpy than the preceding.

Size. Approximately 1 cm. thick.

Colour. Bright red in life, very pale brown in preservative. This has slightly more of a vermilion tinge than the preceding.

Consistency. Firm.

* Ann. & Mag. Nat. Hist. ser. 5, vol. v. p. 487.

† Journ. Linn. Soc. London, vol. xv. p. 476.

Surface appearance. Minutely and densely hispid (velvety).

Oscula. Small, in depressions.

Pores. Minute, abundant.

Ectosome. There is a dense plush of outwardly pointing slender rhaphides or tylostyles, beneath which is a layer densely packed with chelas.

Parenchyma. This is an isodictyal reticulation of the *Myxilla* type, most of the meshes triangular with sides of one spicule-length, but made up of several spicules side by side. There are no fibres or spicular tracts. The groundmass is permeated by meandering canals 0·1 to 0·4 mm. in diameter, and 1 to 2 mm. apart.

Skeleton. (1) Acanthotylotes, abundant, sometimes almost acanthostrongyles, size 0·01 × 0·13 mm. These make up the bulk of the spiculation, the meshes of the reticulation.

(2) Acanthotylostyles, not numerous, size 0·012 × 0·18 mm. These project at acute angles into the meandering canals mentioned above.

(3) Rhaphides or very slender tylostyles, 0·003 × 0·18 mm. These make up the dermal plush.

(4) Toxas, not numerous, length 0·04 mm.

(5) Palmate isochelas, abundant, length 0·01 to 0·016 mm.

The genus *Plocamia* was established in 1870 by O. Schmidt* for *P. gymnazon.* His original generic diagnosis refers too specifically to the genotype and the group is usually described as by Vosmaer †. "Besides styles there are spined tylotes and often also toxas and chelas, but these are not numerous."

P. lithophœnix expands the genus in that it does not have the large smooth styles and does have the chelas abundantly. These differences do not warrant the erection of a new genus.

S. O. Ridley, in 1881 ‡, proposed to substitute the name *Dirrhopalum* for *Plocamia* because of the older plant-genus *Plocamium*, but the rules of nomenclature do not prevent duplications of names as between Botany and Zoology, and, furthermore, the difference in the two names is probably great enough to allow both to stand, even though in the same kingdom.

P. lithophœnix, as mentioned above, is unique in having no smooth shafted megascleres, and further differs from each of the other species in at least two or three respects, so that it is difficult to select any one closest relative for it.

* Spongien Atlant. Gebiet. p. 62.
† 'Das Thier-reich,' vol. ii. p. 357.
‡ Journ. Linn. Soc. London, vol. xv. p. 476.

Ophalitaspongia pennata, Lambe, 1894 *.

This sponge was originally described from Sooke, Vancouver Island, B.C., as *Desmacella pennata*, and some additional information concerning it is in order at the present.

Loc. Vancouver Island (as mentioned above), rare. Monterey Peninsula, abundant; and Laguna Beach, Orange County, southern California, rare.

Hab. From half-tide to at least a few feet below low tide. This favours more exposed situations than any other local sponge, but also competes for space with the other red sponges.

Shape. Encrusting.

Size. Usually less than 5 mm. thick, but one specimen was found 15 mm. thick.

Colour. Usually bright red, but some are brownish even in life.

Consistency. Firm, slightly spongy.

Surface appearance. Minutely hispid (velvety). A dried specimen shows a very characteristic stellate figure of five to seven radiating grooves placed around each osculum as a focal point. This does not show in the field, so identification cannot be made sure without magnification at least great enough to show the shape of the megascleres.

Oscula. Sometimes as common as one per square cm., 0·3 mm. diameter, and in shallow depressions as described above. When the sponge is active a transparent "chimney," such as described for some fresh-water sponges, bulges out above them.

Pores. Minute, abundant.

Ectosome. A thin transparent dermal membrane is stretched over the surface in life; Lambe records spicules in it, but I find few, if any.

Parenchyma. There are ascending plumose fibres connected irregularly with each other by ill-defined secondary spicular tracts. Lambe records these as only near the surface, but Monterey specimens show them well distributed. The ascending fibres branch and anastomose irregularly.

Skeleton. (1) Styles with slightly constricted necks, or, one might say, tylostyles with heads no larger than the shafts. Lambe records some with heads faintly spined. No such modification was found in the Californian sponges, though over a hundred specimens were carefully examined. This

* Trans. Roy. Soc. Canada, vol. xii. p. 129.

species should perhaps be split into varieties. The megascleres are closely of a size in a given sponge, but vary greatly between different specimens. Some are as small as $0{\cdot}013 \times 0{\cdot}15$ mm., others as large as $0{\cdot}02 \times 0{\cdot}37$ mm. They both core and echinate the main fibres and core the connectives or secondary fibres.

(2) Rhaphides or slender tylostyles, approximately $0{\cdot}004 \times 0{\cdot}12$ mm., not common, varying greatly in size, and presumably representing young stages of the megascleres.

(3) Toxas, in the Californian forms 0·03 to 0·045 mm., in the Vancouver forms 0·07 to 0·25 mm.

(4) Palmate isochelas, 0·012 to 0·015 mm. long, and rare; entirely missing in Lambe's specimens. Had he found them he might have had less difficulty in properly allocating this sponge.

All four species discussed in this paper are eaten persistently by a small nudibranch, *Rostanga pulchra*, which exactly matches them in colour. Its colour does not change, however, when, as sometimes happens, we find it eating some duller-coloured sponge.

There are three or four well-marked varieties of *O. pennata* suitable as material for an entire article. I am accumulating statistics as to the very definite ecological relationships of these varieties, and hope to have the results ready for publication soon. This much may be said now, that in some situations this species has no microscleres at all, in others toxas but no chelas, in others a full complement of fairly numerous microscleres. This may have significant bearings on Dendy's startling but well-defended theory as to the existence of spicule-causing "sclerococci" *.

Types of the new species mentioned above are to be placed in the United States National Museum and cotypes in the British Museum (Natural History).

Pacific Grove,
California.

XXV.—Cyclops latipes, *sp. n.* By A. G. Lowndes, M.A., F.L.S., Biologist, Marlborough College.

Cyclops latipes, sp. n.

This species closely resembles *Cyclops vulgaris*, Koch, and *Cyclops gigas*, Claus, but it also shows many characteristics that prevent its being referred to either, and it is therefore given specific rank.

* Quart. Journ. Micr. Science, n. ser. 277, vol. lxx. part 1.

Specific Characteristics and Measurements of the Adult Female.

Note.—All measurements are given in millimetres and are taken from the living animal.

Length exclusive of setæ	1·9
Length of trunk	1·2
„ tail	·7
„ cephalic segment	·64
„ genital segment	·26
„ last three tail-segments	·256
„ caudal rami (inner edge)	·184
„ inner apical seta	·76
„ outer apical seta	·600
„ inner corner seta	·188
„ outer corner seta	·124
Width of cephalic segment	·66
„ fourth trunk-segment	·360
Greatest width of genital segment	·256
Least width of caudal rami	·034
Ratios:	
Trunk : tail	1·71 : 1
Cephalic segment : next four segments	1·14 : 1
„ „ length : width	1 : 1·03
Trunk, length : width	1·82 : 1
Genital segment, length : width	1·02 : 1
„ „ length : next four segments	1·02 : 1
Caudal rami, length : least width	5·4 : 1
„ „ length : inner corner seta	*1 : 1·01*
„ „ length : outer corner seta	1·48 : 1
Length of inner corner seta : outer corner seta	*1·52 : 1*
Longer apical seta : tail	1·08 : 1
Longer apical seta : shorter	1·26 : 1

The lateral parts of the fourth and fifth trunk-segments are produced in a way similar to C. lucidulus, *Koch.*

The anterior antenna consists of seventeen segments and does not reach beyond the edge of the cephalic segment. The caudal rami are elongated and slightly tapering; they are not divergent; they bear hairs along their inner edges.

Fifth swimming-foot two-jointed, second joint bears a long seta and a small spine which is attached about the middle of the joint; the spine is not denticulate.

Ratio of width to length of second joint 12 : 20.

The seminal receptacle is broad in front and is practically identical with that of *C. vulgaris.*

The ovisacs are broad and often large, but they vary; they are never divergent in the living animal, but always conspicuously adpressed.

Colour a dark greyish or brownish green, not a bright green.

Spine-formula 2.3.3.3.
Seta-formula 4.4.4.4.
Terminal joint and spines of the inner ramus of the fourth swimming-foot:

Length of joint	·08 mm.
Width of joint (greatest)	·044 „
Length of inner terminal spine	·068 „
„ outer terminal spine	·060 „

Ratios;

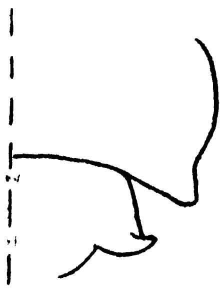
Length of joint : width	1·82 : 1
„ joint : inner terminal spine	1·18 : 1
„ inner term. spine : outer term. spine	1·14 : 1

The terminal joints of both rami of the fourth swimming-foot are broad and not elongated. The setæ in both joints, but more especially in the outer joint, extend far beyond the tips of the terminal spines.

Diagnosis.—This species seems to be intermediate between

Fig. 2.

Fig. 1.



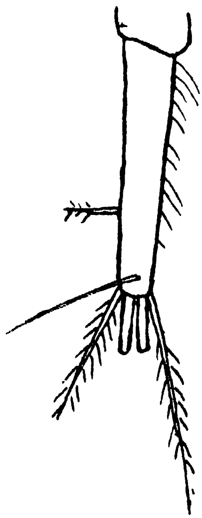


Fig. 1.—Lateral processes on trunk-segments 4 and 5.
Fig. 2.—Caudal rami (apical setæ are not shown).

C. vulgaris, Koch, and *C. gigas*, Claus, but at the same time it cannot rightly be referred to either, and in some ways it resembles *C. lucidulus*, Koch.

The caudal rami are too elongated for *C. vulgaris*.

The inner corner setæ of the caudal rami are not long enough for that species, since they are by no means twice the

length of the rami, nor are they twice the length of the outer corner setæ.

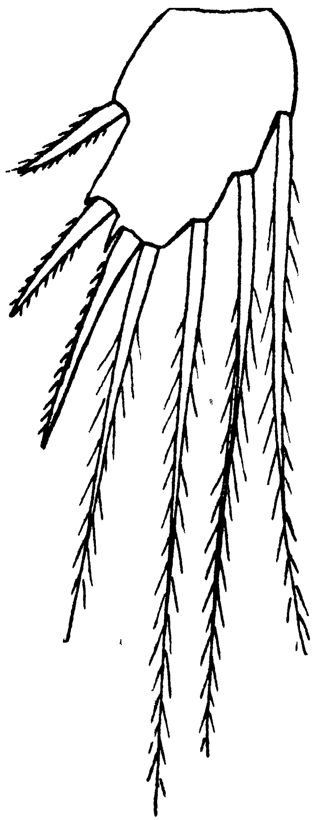
The outer corner setæ are too fine for *C. vulgaris.*

The ovisacs are very definitely adpressed.

From C. gigas *it differs in the following points*:—

It is too small. The terminal joint of the inner ramus of

Fig. 3.



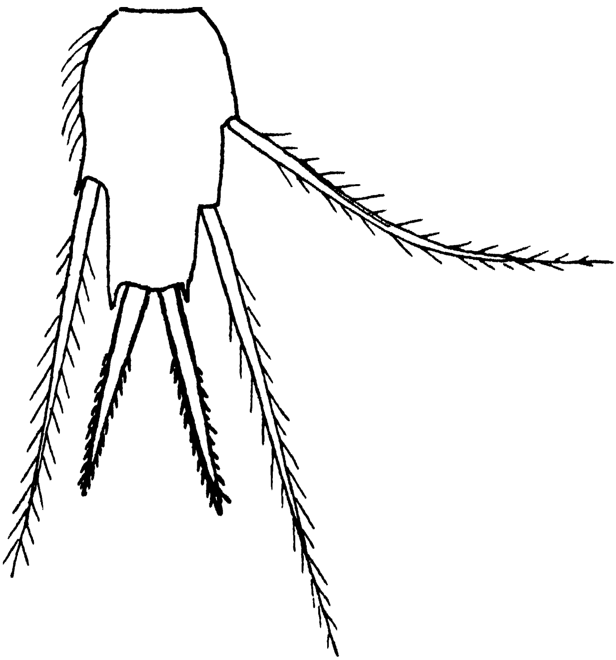
P. 4, terminal joint, outer ramus.

P. 4 is not elongated or attenuated, nor are the terminal spines sufficiently long or fine.

Neither of the above species bears the long setæ on this same joint as mentioned above, nor are the lateral parts of the two last trunk-segments produced.

Both *C. vulgaris* and *C. gigas* are admittedly very variable species, and it would seem that the only way of coming to a decision on these border-line species is to carry out a series of breeding experiments, and thus to decide what characteristics are specific and what are not; but, in the absence of these, there is no excuse for referring this species to any species from which it definitely differs in so many points.

Fig. 4.



P. 4, terminal joint, inner ramus.

Occurrence.—This species occurs abundantly in the Marlborough district at all seasons, but it usually occurs in ponds which are prone to dessication. Range of pH so far found 6 4–7·2.

Length of male 1·5 mm.

I have sent specimens of this animal to Professor Sars and also to Fredrich Kiefer, of Heidelberg, and Mr. Robert Gurney, all of whom have very kindly examined them for me, and apparently agree that it should be given specific rank.

XXVI.—*On a new Race of Bongo and of Gorilla.* By Lord ROTHSCHILD, F.R.S.

(1) *Boöcercus eurycerus katanganus*, subsp. n.

♂ ad. Differs from both *B. e. eurycerus* and *B. e. isaaci* in its shorter and proportionately much stouter horns, shorter head, and in having the face-markings almost the same shade of brown-red as the neck and fore part of the body, whereas in both the other races these face-markings are black or dark brown, sharply defined from the brown-red of the rest of the body. The transverse white face-band is narrower. Back of the ears red.

Horns along front curve 28⅛ inches=703·5 mm.; in a straight line 23 inches=575 mm.; girth 11½ inches=288 mm.; tip to tip 9½ inches=238 mm.

The corresponding measurements of my two *B. e. eurycerus* are: along front curve 35 inches=875 mm.; in a straight line 29⅞ inches=749·5 mm.; girth 10 inches=250 mm.; tip to tip 9 inches=225 mm., and 32½ inches=800 mm., 26⅞ inches=674·5 mm., 11 inches=275 mm., 9¾ inches=243·8 mm. My male *B. e. isaaci* measures 33¾ inches=843·8 mm., 27⅝ inches=593·5 mm., 11 inches=275 mm., 13¾ inches=343·8 mm.

Hab. Katanga Province, Belgian Congo (type, ♂ ad., entire, mounted, Djingilé, Kabouso Territory, Laurami District).

(2) *Gorilla gorilla halli*, subsp. n.

Differs from both *g. gorilla* and *g. matschiei* in being paler and of decided liver-brown appearance; arms, shoulders, sides and top of head grizzled brown (*i. e.*, brown intermixed with grey hairs). Back, legs, and hind neck mouse-grey; back of head pale brown; feet and hands sooty black. Appears to be much shorter in height and much more stockily built, owing to the different proportions of some of the long bones. Hair shorter and sparser.

I give the measurements of humerus, ulna, and femur of *G. g. matschiei* and *G. g. halli*:—

	Humerus.	Ulna.	Femur.
G. g. halli....	17¼ in.=43·5 mm.	13½ in.=34·25 mm.	13¼ in.=33·3 mm.
G. g. matschiei.	17½ in.=44·5 mm.	14¾ in.=37·5 mm.	15 in.=38 mm.

(I will discuss the skull-differences later on.)

This animal is named after its owner, Mr. John Hall, of Charnes Hall, Stafford.

Hab. Punta Mbouda, Spanish Guinea (*Dr. Leon Fadhi Coll.*).

XXVII.—Paradrymadusa philbyi, *sp. n.*, *and some other Orthoptera from Transjordania and Arabia.* By B. P. Uvarov.

A VERY small lot of Orthoptera taken by Mr. H. St. J. B. Philby, C.I.E., proved to be of great interest, including one new long-horned grasshopper. It enabled me to give practically the first records of Orthoptera from Transjordania *, and to increase a little our knowledge of the fauna of Arabia, which still remains as good as unexplored with regard to Orthoptera. It is to be hoped that such important results of apparently incidental collecting will stimulate the persons who happen to collect in those countries to pay more attention to this badly neglected group of insects. Many discoveries of new species, even genera, may be confidently expected from the deserts of S.W. Asia, while complete lists of local faunas will throw light on the composition and origin of the whole fauna of great Palæarctic deserts.

A list of species included in the collection is as follows :—

Mantidæ.

Empusa fasciata (Brullé).

One male from Amman. Common in Palestine, but not recorded from Transjordania.

Tettigoniidæ.

Lezina (=*Magrettia*) sp.

One male (immature) from Amman, Transjordania.

This is a member of a very little-known typically desert genus, remarkable for its entirely apterous body and primitive unchitinized female genitalia. One species is known from Egypt, one from Somaliland, two from Persia, and one from Transcaspia, but I am unable to identify the Transjordanian insect, as it is only half-grown. All species are known to be nocturnal in habits, occurring mainly in localities abounding with stones, under which they may be found in the daytime, while at night they are attracted by lights. (For a fuller account see Uvarov, Bull. Min. Agric. Egypt, no. 41, 1924, pp. 12–14.)

* A few records are to be found in the paper by Buxton and Uvarov, Bull. Soc. Roy. Entom. Egypte, 1924 (for 1923), pp. 167–214.

Paradrymadusa philbyi, sp. n.

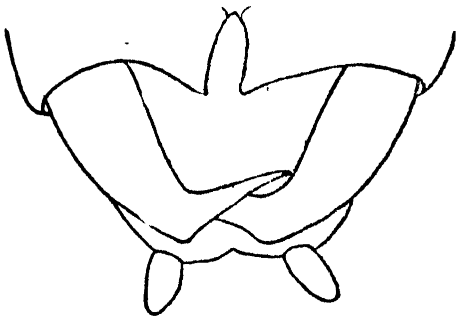
♂. Of medium size for the genus.

Fastigium of vertex pear-shaped, less than half as broad below as it is in its widest part; surface flattened, with a fine median sulcus.

Pronotum short and broad; anterior margin very feebly excavate; metazona almost flat; lateral lobes convex in the middle, but depressed near the anterior and the posterior margin, with the result that there is a suggestion of very short and round lateral keels in front of the first sulcus and rounded shoulder projections in metazona. Prosternum with a pair of very short and blunt tubercles (in place of spines).

Elytra oval, almost reaching the third tergite.

Legs moderately long. Anterior and middle femora armed each with three fairly strong spines on the anterior



Paradrymadusa philbyi, sp. n., ♂, type; end of abdomen.

lower margin; hind femora with eight to ten irregularly placed spines on both lower carinæ.

Last tergite somewhat projecting in the middle and dissected into two triangular lobes. Cerci rather short, round, slightly incurved, armed apically with a long spine which forms nearly a right angle with the cercus. Subgenital plate with a broad and shallow emargination; styli short.

General coloration pale ochraceous (perhaps somewhat discoloured by preservation in alcohol). Face with a pair of elongate brownish spots near its middle; clypeus with a pair of small round brownish spots; suture separating clypeus from the face also brownish, except in the middle portion. Antennæ without definite rings, brownish, with the apices of joints slightly and narrowly paler. Pronotum with very

faint traces of the pattern typical in *Drymadusa*; a small streak at the middle of anterior margin, a faint median line on the metazona, and shadows under the upper margins of lateral lobes in front and behind are brownish. Elytra with some cells slightly darkened. Tergites with blackish-brown dots on their hind margins. Anterior and middle femora on the anterior surface with four black spots—one at the base of the femur and three at the base of spines; upper side with a brownish preapical ring. Hind femora with one or two small brown spots on the outer side beyond the middle, and with several spots of the same colour near the base of the inner side; preapical ring very pale brownish; hind tibiæ with brown spots along the lower side.

Length of body 25 mm.; pronotum 8; elytra 5; anterior femur 9·5; posterior femur 25·5.

Described from a single male, taken at Amman, Transjordania. Type in the British Museum.

This new species differs strikingly from all others in which we know the male sex, and need not be compared with them. It seems, however, to resemble two species described only from females, which should never be done in this group, where female characters are very uncertain.

One of the two species in question is *P. syriaca*, Pictet, from unknown locality in Syria. It appears to differ from our species by longer elytra, which even in the female are nearly as long as pronotum, by very small spinules of the femora, and the absence of blackish spots on them, as well as by the relatively shorter hind femora. It is not impossible, however, that the male mentioned by Giglio-Tos (Boll. Mus. Torino, viii. no. 164, 1893, p. 14) as that of *P. syriaca* belongs to our species, though the description of genitalia is not very lucid.

Another species resembling *P. philbyi* is *P. maculata*, Ebner, from Diarbekir, but it is a considerably smaller insect, with densely distributed dark spots all over.

This is the sixteenth species of the genus; all the known species are distributed in the dry mountainous or hilly regions of S.W. Asia, ranging from Greece and Crimea to Persia and Transcaucasia. The actual number of species must be much greater, since new ones are being continually described.

Saga syriaca, Luc.

One male from Amman, Transjordania.

This species is certainly very close to the Transcaucasian *S. ephippigera*, F. W., as has already been pointed out by

Ebner (Ann. Naturhist. Hofmuseums, Wien, xxvi. 1912, pp. 443–446), but it seems better to leave the question of synonymy not settled until a thorough revision of the genus is undertaken.

Acrididæ.

Aiolopus affinis, Bol.

One male from Jeddah, Arabia, 16. xii. 1924.

Ranging from India into Palæarctic deserts, but not yet recorded from Arabia.

Acrotylus longipes, Charp.

One male from Jeddah, Arabia, 16. xii. 1924.

Tmethis cisti (F.).

Two males and one female from Amman, Transjordania.

Pyrgomorpha cognata, Kr.

One female from Jeddah, Arabia, 6. xii. 1924.

Anacridium ægyptium (L.).

One female from Amman, Transjordania.

XXVIII.—*On a new Genus of Acanthocephala from Rangoon.*

By K. Subrahmanian, B.A., Biology Department, University of Rangoon.

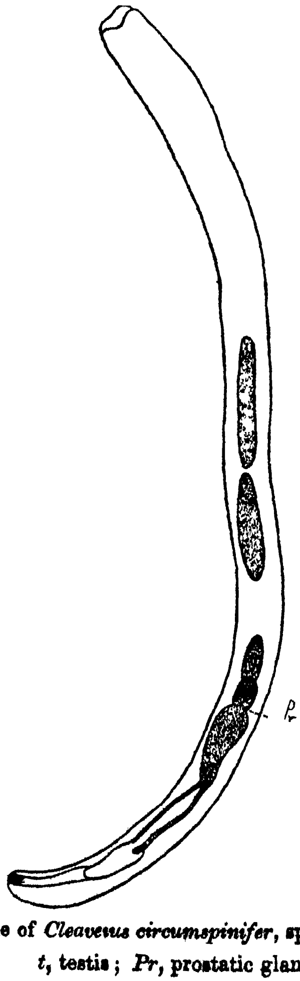
Through the courtesy of Professor Meggitt I had the opportunity of examining some specimens of Acanthocephala he had collected during his dissections. A study of the specimens has revealed a form belonging to the family Rhadinorhynchidæ which cannot be included within any genus hitherto described. Consequently a new genus—*Cleaveius*—is proposed for the form, and the new species *Cleaveius circumspinifer* is designated as the genotype. As there were only two specimens, which were not in good condition, a complete description of the form is impossible.

I here take the opportunity of thanking Professor Meggitt for the help which he rendered me at almost every stage of my work.

CLEAVEIUS, gen. nov.

Generic Diagnosis.—Rhadinorhynchidæ. Body of medium size. Anterior region armed with scattered spines. In the female approximately two-thirds of the body armed with circular rows of spines. Proboscis-receptacle long, composed of two layers of muscle. Central nervous system situated on the side of the proboscis-receptacle, a little anterior to the posterior end of proboscis-sheath.

Fig 1.



Male of *Cleaveius circumspinifer*, sp. n. × 31.
t, testis; *Pr*, prostatic glands.

Cleaveius circumspinifer, sp. n.

Specific Diagnosis.—With the characters of the genus. Proboscis in the female armed with about 18 longitudinal rows of hooks, about 4 hooks in each row. Body of both sexes cylindrical, of almost uniform diameter throughout. Type male 5·1 mm. long, diameter 0·21 mm. Anterior portion of body not armed with scattered cuticular spines. Body as far as the commencement of the posterior testis armed with about 23 rows of spines 27 μ long. Testes two, elongated, in the longitudinal axis of the body, one posterior to the other. Anterior testis 612 μ long, diameter 79 μ. Posterior testis 490 μ long, diameter 105 μ. Prostatic glands

Fig. 2.

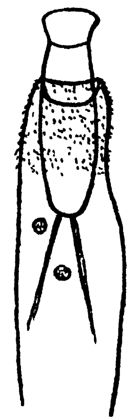


Fig. 3.

Fig. 2.—Anterior end of female of *Cleaveius circumspinifer*, sp. n., × 36.
Fig. 3.—A single body-spine of female, × 460.

4 compact bodies. Lemnisci 2 much coiled. Type female 8·1 mm. long, maximum diameter anteriorly below posterior end of proboscis-receptacle 0·38 mm., diameter in the middle of body 0·25 mm. Anterior portion of body to a distance of 262 μ armed with scattered spines 27 μ long. About two-thirds of body armed with approximately 41 circular rows of spines, about 14 spines in each row 25–30 μ long. Rows of spines 52 μ apart anteriorly, posteriorly 124–137 μ. Proboscis short, cylindrical, constricted in the middle, 157 μ long, diameter anteriorly 175 μ, middle 105 μ, and posteriorm. 140 μ. Proboscis armed with about 18 longitudinal rowrrom hooks with about 4 hooks in each row. Largest hoo/luding

Genera of the Family Rhadinorhynchidæ.

Genus.	Proboscis.	Number of longitudinal rows of hooks.	Number of hooks in each row.	Size of hook.	Proboscis-receptacle.	Brain.	Lemnisci.	Armature of body.	Host.
Leptorhynchoides ..	Very long, slightly club-shaped.	....	...	....	...	....	Very long.	Absent.	Fish.
Serrasentis	....	....	....	....	....	..	Very long.	Ventral transverse rows of spines.	Fish.
Telosentis	Cylindrical to club-shaped, 1·14–1·3 mm.	12	20	48–60 μ	2·2 mm.		Approximately the same length as proboscis-receptacle.	Posterior extremity of body adjacent to genital orifice armed in both sexes with a few scattered cuticular spines.	***Atherina hepsetus.***
Rhadinorhynchus ..	Very long.	....	....	....	Very long.	Near middle of proboscis-receptacle.	Long and finger-like.	Anterior region of body armed with scattered cuticular spines.	Adult in intestine of fish.
Arythmorhynchus ..	....	Characteristic oval swelling not far from anterior region of body.							Birds.
Cleaveius, gen. nov.	157 μ long diameter, anterior 175 μ, middle 105 μ, posterior 140 μ.	18	4	Largest hook 55 μ, smallest 30 μ.	630 μ long.	Placed laterally 157 μ from posterior end of proboscis-receptacle.	Coiled.	In the female body armed with circular rows of spines. Anterior region of body armed with scattered spines.	Fish.

and the smallest 30 μ long. A portion of the proboscis 55 μ long is unarmed. Proboscis-receptacle composed of two layers of muscle 630 μ long, diameter 175 μ. Retractors of proboscis well developed, attached to the tip of the proboscis, pass through the body-cavity backwards as the retractors of the proboscis-receptacle. Central nervous system placed laterally 157 μ from posterior end of proboscis-receptacle. Female reproductive system, well developed, extends to a distance of 278 μ from posterior end of body. Body-cavity full of immature embryos.

Type Host. Intestine of unidentified freshwater fish.

Locality. Rangoon, Burma.

The accompanying comparative table (p. 278) distinguishes this genus from the remainder.

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XXIX.—*On Two new Species of* Oxysomatium (*Nematoda*), *with some Remarks on the Genus.* By H. A. BAYLIS, M.A., D.Sc.

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1. *Oxysomatium hylambatis*, sp. n. (Figs. 1 & 2.)

Habitat. Rectum of a Tree-frog, *Leptopelis* [*Hylambates*] *aubryi* (A. Duméril).

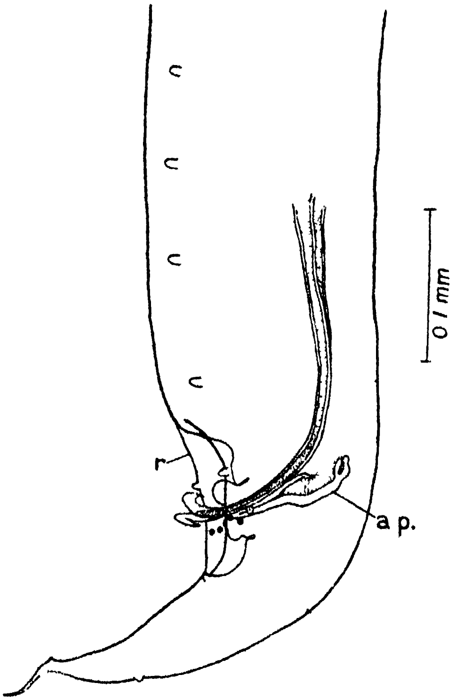
Locality. Macenta, French Guinea, West Africa.

A number of specimens of this form were collected by Mr. H. W. Parker from a preserved frog of the above-named species. The following description is based on three males and four females.

Length of male 4·0–4·2 mm.; of female 5·3–6·0 mm. Maximum thickness 0·26–0·3 mm. in male; 0·3–0·37 mm. in female. Cuticular striations very fine. Distance from anterior extremity to posterior end of œsophagus, including

bulb, 0·7 mm. in the male, 0·76–0·85 mm. in the female. Nerve-ring at 0·3–0·33 mm., and excretory pore at 0·53–0·65 mm., from anterior extremity. At the anterior end of the œsophagus there is a pharynx, measuring 0·075–0·088 mm. in length. The œsophageal bulb measures, in the male, 0·14–0·15 mm. in length and 0·1–0·12 mm. in width; in the female, 0·18–0·19 mm. × 0·14–0·15 mm. (The measurements of length include the narrow anterior "neck" of the bulb.)

Fig 1.



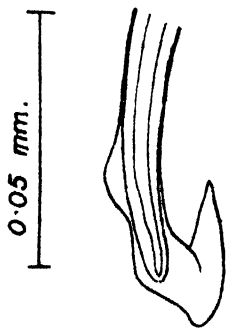
Oxysomatium hylambatis. Caudal end of male; lateral view. *a.p.*, accessory piece; *r.*, cuticular ridge.

The tail of the male (fig. 1) is about 0·2 mm. long, and tapers to a very fine point. The lips of the cloacal aperture are very prominent, and the cloacal region presents a ventral depression bounded laterally by cuticular ridges (fig. 1, *r.*) resembling alæ. Apart from these, however, there are no caudal alæ. The caudal papillæ are very prominent. There are apparently five pairs of relatively large preanal papillæ

and six pairs of smaller postanal papillæ. Of the postanal papillæ, one pair (the second from the posterior end) is subdorsal, the rest subventral. Three of the subventral pairs are grouped close together in the cloacal region. The spicules are subequal. A striking peculiarity is that the tip of each spicule (figs. 1 & 2) is encased in a curious hyaline sheath in the form of a hook. Excluding this hyaline portion, the spicules measure 0·24–0·28 mm. in length. The accessory piece (fig. 1, *a.p.*) is large and well chitinized, and measures 0·09–0·1 mm. in length.

The tail of the female is 0·28–0·31 mm. long, and tapers to a fine point, like that of the male. The vulva is situated at about the posterior third of the body (at 1·8 mm. from the posterior end in a specimen 5·4 mm. long). The

Fig. 2.



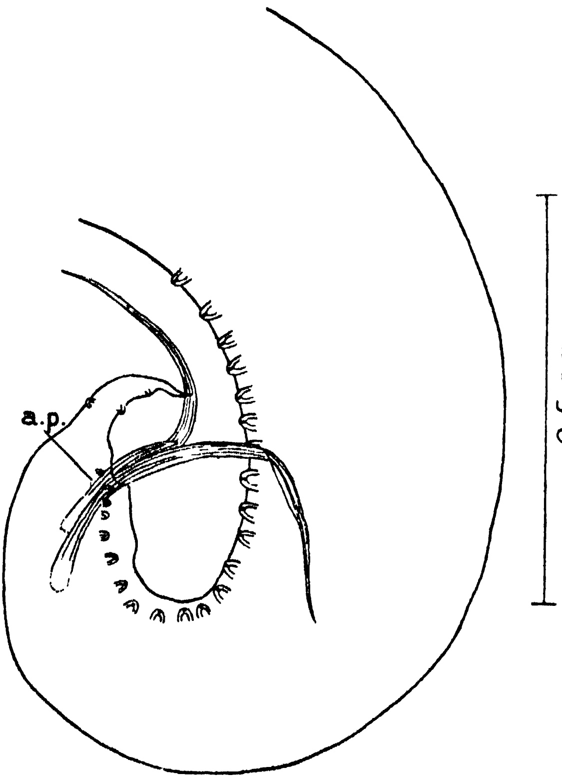
Oxysomatium hylambatis. Extremity of one of the spicules, showing the hook-like hyaline sheath.

vagina runs anteriorly from it. The eggs measure about $0 \cdot 1 \times 0 \cdot 055$ mm., and contain embryos *in utero*.

This species is not unlike *O. dogieli*, Skrjabin, 1916, from an East African toad. This, however, is a somewhat larger form, and the tail of the female is more bluntly conical. The arrangement of the caudal papillæ in the male is different, and *O. hylambatis* lacks the serrated border surrounding the excretory pore, observed by Skrjabin in *O. dogieli* and thought by him to indicate relationship with the genus *Atractis*. The prominent transverse striation of the lining of the cylindrical portion of the œsophagus, noticed by Skrjabin in *O. dogieli*, is present in *O. hylambatis*, and is also well marked in the genotype. *O. perezi*, Gendre, 1911, from a chamæleon from the same part of Africa as the

present species, is apparently even more closely related to it. This form again, however, is larger, and differs in several particulars, notably in the arrangement of the caudal papillæ of the male. A striking point of resemblance is that the tips of the spicules in *O. perezi* are surrounded by hyaline sheaths, as in *O. hylambatis*, but Gendre's description and figure do not indicate that these sheaths take the form of hooks. They appear rather to be bluntly rounded.

Fig. 3.



Oxysomatium tibetanum. Caudal end of male; lateral view. *a.p.*, accessory piece.

2. *Oxysomatium tibetanum*, sp. n. (Fig. 3.)

Habitat. Rectum of a toad, *Scutiger* [*Cophophryne*] *alticolus* (Procter, 1922).

Locality. Kharta Valley, Tibet.

This species is represented by two male specimens, found by Miss J. B. Procter while examining the type-specimen of the host, which was collected by the Mount Everest Expedition in 1921. The specimens are not in very good condition, and the following brief description may require some correction in the future, should further material become available.

Length 4·5–5·0 mm. Maximum thickness 0·36–0·45 mm. (probably somewhat exaggerated by cover-glass pressure). Cuticular striations very fine. Distance from anterior extremity to posterior end of œsophagus, including bulb, 1·0–1·1 mm. Nerve-ring at 0·42 mm., and excretory pore at 0·65 mm., from anterior end. Length of pharynx about 0·1 mm. Œsophageal bulb 0·19–0·2 mm. in length (including the anterior "neck"), and 0·15–0·16 mm. in width. Length of tail about 0·17 mm. Caudal papillæ very prominent, apparently twenty-two pairs preanal and four (?) pairs postanal. The third pair from the posterior end is subdorsal. Spicules about 0·58 mm. long, tapering to fine points without hyaline caps, and alate. Accessory piece about 0·188 mm. long.

The Genus Oxysomatium.

The name *Oxysomatium* was proposed by Railliet and Henry to replace *Oxysoma*, Schneider, 1866, which was preoccupied by *Oxysoma,* Gervais, 1849. Two of the species referred by Schneider to *Oxysoma* have been shown to belong to other genera, so that of the three original species only *O. brevicaudatum* remains. Railliet and Henry (1916 *a* and *b*) quote the date of their first use of the name *Oxysomatium* as 1913, but the writer has been unable to trace this reference. These authors performed a great service by their effort to produce some order out of the chaos in which the genera and species of Oxyuridæ were involved. In the case of *Oxysomatium,* however, they seem to have introduced an unnecessary complication. In their first paper (1916 *a*) they made the *Oxysoma brevicaudatum* of Schneider (1866) the type of the genus, but in their second paper (1916 *b*) stated their opinion that this was not identical with *Fusaria brevicaudata,* Zeder, 1800. They accordingly renamed Schneider's species *Oxysomatium longespiculum,* and referred Zeder's species to the genus *Aplecta* (subsequently found to be preoccupied and emended to *Aplectana*), of which *A. acuminata* (Schrank, 1788) was made the type.

A study of Zeder's (1800) description and figures of

Fusaria brevicaudata strongly suggests that what he had before him may have been a mixture of the two common parasites of toads and frogs which have now come to be known as *Aplectana acuminata* and *Oxysomatium longespiculum* respectively. His figure of the tail of the male (1800, pl. v. fig. 5) seems to belong to *O. longespiculum*, while that of the female (fig. 4), with its indication of a lateral ala, more probably represents *A. acuminata*, although the terminal filament of the tail appears too short. Most of the discrepancies between Zeder's and Schneider's descriptions pointed out by Railliet and Henry (in so far as they are not accounted for by the supposition of Zeder's mixture of species) can readily be accounted for by inaccuracies on the part of one or other, or both, of the original describers, while some of them do not appear to exist. Railliet and Henry state, for instance, that Schneider's species differs from Zeder's in having alate spicules; but Zeder's figure of the tip of a spicule (pl. v. fig. 6) shows quite plainly that it was alate in his species. The spicules were, in fact, described by him as "scharf dreyeckig." Railliet and Henry also state that Schneider's species lacks an accessory piece ("gorgeret"), and that this is a point of difference from Zeder's species. Neither Schneider nor Zeder mentions or figures this organ, so that this diagnostic character does not, in fact, exist.

It seems to the writer, therefore, that the grounds for supposing that Schneider's *Oxysoma brevicaudatum* was distinct from Zeder's *Fusaria brevicaudata* are insufficient. This being so, there seems to be no reason why it should not retain the trivial name given to it by Zeder, and be called *Oxysomatium brevicaudatum* (Zeder, 1800), of which *O. longespiculum*, Raillet and Henry, 1916, becomes a synonym.

Skrjabin (1916) gave a diagnosis of the genus *Oxysomatium* which, in our present state of knowledge, is sufficient to define it and distinguish it from related genera. This diagnosis has been closely followed by Baylis and Daubney (1926). Skrjabin gave *O. brevicaudatum* (Zeder) as the genotype. In addition, he considered that four other species could be referred to the genus, viz.: *O. contortum* (v. Linstow, 1906), *O. unguiculatum* (v. Linst., 1906), *O. perezi* (Gendre, 1911), and *O. dogieli*, Skrjabin, 1916. Yorke and Maplestone (1926), in their book on the Nematode Parasites of Vertebrates, have, as it seems to the writer, fallen into an unfortunate error, in which they have perhaps been influenced by a paper by Miranda (1924), and which is likely to cause fresh confusion if not corrected. While accepting *O. longespiculum* as the genotype of *Oxysomatium*, they appear to

have figured the same species as "*Aplectana brevicaudata*," and have referred to *Aplectana* not only this species, but all the others which, as shown by Skrjabin, should be referred to *Oxysomatium*. Indeed, it seems probable that all the contents of the genus *Aplectana*, as given by Yorke and Maplestone, with the exception of the genotype, should be referred to *Oxysomatium*. There is room for doubt in the case of several of the species, but at all events the following should, in the writer's opinion, probably be regarded as species of *Oxysomatium* :—

	Hosts.
1. *O. brevicaudatum* (Zeder, 1800) (=*longespiculum*, Railliet and Henry, 1916)	*Rana, Bufo*, etc.
2. *O. unguiculatum* (Rudolphi, 1819)	*Amphisbæna.*
3. *O. contortum* (v. Linst., 1906)	*Bufo.*
4. *O. perezi* (Gendre, 1911)	*Chamæleon.*
5. *O. dogieli*, Skrjabin, 1916	A Bufonid.
6. *O.* [*Aplectana*] *pusillum* (Miranda, 1924)	*Amphisbæna.*
7. *O.* [*Aplectana*] *raillieti* (Travassos, 1925)	*Amphisbæna.*
8. *O. simples*, Travassos, 1925	*Hyla.*
9. *O. hylambatis*, sp. n.	*Leptopelis.*
10. *O. tibetanum*, sp. n.	*Scutiger.*

The following species may be more doubtfully referred to the genus, pending a more complete knowledge of their morphology :—

	Hosts.
Oxysoma terdentatum, v. Linst., 1890	*Triton.*
Oxysoma tuberculatum, v. Linst., 1903	*Megalophrys.*
Oxysoma macintoshii, Stewart, 1914	*Rana, Bufo.*
Aplectana linstowi, Yorke and Maplestone, 1926 (=*Nematoxys unguiculatus*, v. Linst., 1906, nec *Ascaris unguiculata*, Rud., 1819)	*Bufo.*

The original descriptions of these four species make no mention of the existence of an accessory piece in the male, while in *O. terdentatum* there is, according to v. Linstow's description, no œsophageal bulb. The absence of this structure, however, would exclude the species altogether from the family Oxyuridæ. The British Museum (Natural History) possesses co-type specimens of *O. macintoshii*, but unfortunately these are all females, and the presence or absence of an accessory piece therefore cannot be determined.

Regarding *Ascaris fæcunda*, Rud., 1819, which is doubtfully referred to *Aplectana* by Yorke and Maplestone, there seems to be no evidence at present which would enable its position to be determined. *Leptodera membranosa*, Schneider, 1866, is included by York and Maplestone, along with the

species already mentioned, in *Aplectana*, but in the writer's opinion it cannot be referred to *Oxysomatium*, and probably belongs to the family Rhabditidæ.

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XXX.—*Two new Species of Lower Carboniferous Brachiopoda from Northumberland.* By Helen M. Muir-Wood, M.Sc., F.G.S.

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The material to be described was collected by Mr. A. Templeman of H.M. Geological Survey, and kindly lent to me for description by Mr. J. Pringle, to whom I am also indebted for a list of the associated fossils given below. All the specimens were obtained from shales overlying the Upper Fell Top Limestone, and exposed in a small stream joining Hartley Burn, near Burnfoot, four miles S.S.W. of Haltwhistle. The beds have yielded the following fossils :—

Crinoid ossicles.
Serpulites sp.
Chonetes laguessiana, de Kon.
Productus carbonarius, de Kon.
—— ——, sp. n.*.

* Description by the author to be published shortly in Mem. Geol. Survey on "Carboniferous *Producti*."

Productus pugilis, Phill.
Grammatodon regularis, Hind.
Nuculana sp.
Schizodus antiquus, Hind.
Conularia quadrisulcata, J. Sow.

The presence of such species as *Productus pugilis*, Phill., and *P. carbonarius*, de Kon., indicates a high horizon in the Carboniferous Limestone Series, since *P. carbonarius* ranges from the top of the D_2 subzone up to the Millstone Grit.

Mr. F. M. Trotter (1926, p. 82*), who has surveyed this area, has taken as the base of the Millstone Grit the first bed of thick sandstone overlying these fossiliferous shales, about 110 ft. above the Upper Fell Top Limestone. This limestone represents the D_3 subzone of Prof. Garwood's classification (1910, p. 681) or the subzone DY of Dr. S. Smith (1910, pp. 596, 598).

The new species *Pustula thomasi* has not, so far as is known, been collected from any other locality in Northumberland or from Cumberland. Mr. Pringle informs me that shells comparable to *Punctospirifer northi* have been collected during the progress of the Geological Survey, the results of which are included in the Brampton Sheet of the 1-inch map. The species is first found in shales about the horizon of the Corbridge Limestone, and ranges upwards to the base of the Millstone Grit as defined by Mr. Trotter ; but the early forms are usually smaller than the later ones, and, as a rule, show no trace of that thickening and irregular development of the ornament which is characteristic of the later forms. The "*Spiriferina* sp.," which Dr. S. Smith (1910, p. 627) records without description from the Thornbrough Limestone of Stanton may possibly be a *Punctospirifer*.

Description of Species.

Productidæ, Gray.

Pustula, I. Thomas, 1914, Mem. Geol. Surv. Gt. Britain, Palæontology, i. 4, p. 259.

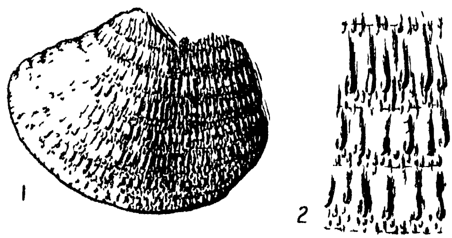
Pustula thomasi †, sp. n. (Text-figs. 1 & 2.)

Diagnosis.—*Pustula* in which the concentric bands are somewhat obscurely defined on the venter, having prominent

* See List of References at end of paper.
† Named after the late Dr. I. Thomas.

and rounded ribs on the flanks, and having no smooth interspaces between the concentric bands.

Description.—The pedicle-valve, 34 mm. long and 40 mm. wide, has an approximately circular outline, is depressed, and has a shallow rounded median sinus; there is no geniculation between the visceral disc and the venter, and no trail is developed; the umbo and hinge are not preserved in the type-specimen. The ornament consists of spine-bases inserted on concentrically-arranged band-shaped areas; each band is about 5 mm. wide on the venter and narrows on the flanks and on the anterior part of the shell, where it is nearly half as wide as on the venter. The spine-bases are of two sizes, major and minor; the major are arranged in a single row on each band and occupy more than three-quarters of



Pustula thomasi, sp. n. Holotype in Museum of Practical Geology [37582].

Fig. 1.—Pedicle-valve incomplete near umbo. Slightly reduced
Fig. 2.—Details of ornament. × 2.

its width, being inserted on its posterior edge or on the anterior edge of the neighbouring band, and extending across the boundary; the minor spine-bases lie in two or three rows on the anterior part of the concentric bands, often overlapping the boundary and extending on to the posterior part of the neighbouring band. The major spines diminish in length on the anterior portion of the shell, and the minor spines become much crowded, while on the flanks the major spines disappear.

Type-specimen.—Holotype, no. 37582, Museum of Practical Geology, London.

Remarks.—*Pustula thomasi* appears to resemble closely *Productus juresanensis*, Tschernyschew (1902, p. 620, and 1914, p. 62, pl. viii. fig. 6, pl. ix. fig. 1), from the Upper Carboniferous, *Schwagerina* Kalk, of the Ural Mountains;

but the bands in the Russian species are more clearly defined.

Pustula subelegans, I. Thomas (1914, p. 298, pl. xvii. figs. 9–12), differs from *P. thomasi* in being smaller and having a more convex shell and narrower concentric bands.

Pustula defensa, I. Thomas (1914, p. 310, pl. xvii. figs. 20–23), from the Six-Yard Limestone of Northumberland (horizon D_2–D_3)—that is, from a lower horizon than *P. thomasi*,—resembles that species in its adpressed spine-bases, but differs from it in its elongate-oval outline, greater convexity, and in its concentric bands, which are separated by smooth grooves and are only 2 mm. wide on the venter.

Suessidæ, Waagen.

PUNCTOSPIRIFER, F. J. North, 1920, Quart. Journ. Geol. Soc. vol. lxxvi. p. 212.

Punctospirifer northi *, sp. n.

Diagnosis.—*Punctospirifer* about 25 mm. in length, with a small apical callosity; having a broader sinus and fold than *P. scabricosta*, North, costæ coarser and of variable width, fewer (7–8) costæ on the lateral slopes, and less prominent and less regular lamellar ornament.

Description.—The much-thickened shell is spiriferoid, alate, about twice as wide as long, and widest at the hinge-line; the cardinal extremities are subangular. The shell-substance is fibrous and strongly punctate.

Pedicle-valve (holotype) 27 mm. long, 46 mm. wide; (specimen B. 47307) 21 mm. long, 42 mm. wide, 8·5 mm. thick; slightly convex, with a broad rounded median sinus at the anterior margin, about four times the width of the bounding costæ. The umbo is acute and slightly incurved. The low cardinal area extends along the whole hinge-line and is sharply differentiated from the lateral slopes. The area is longitudinally striated, flattened along the hinge, but concave near the umbo. The apical angle is 110°; the delthyrial angle 63°. The delthyrium is slightly higher than wide. The deltidial plates are not visible in the specimens examined. There are seven or eight rounded and slightly curved costæ on each lateral slope; their width is inconstant, but increases anteriorly to about 2·5 mm.; the intervening sulci are rounded and of approximately the same width as the costæ; there are six

* Named after Dr. F. J. North.

costæ at the umbo, and the remainder are developed at varying distances from it. The costæ are crossed by concentric growth-lines which frequently form a strong lamellar ornament.

An internal cast of the pedicle-valve shows a narrow median septum and slightly divergent delthyrial supporting plates. The septum passes backwards into a narrow, rounded, apical callosity.

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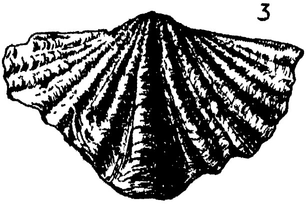

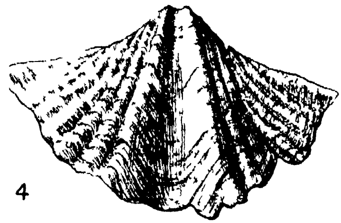

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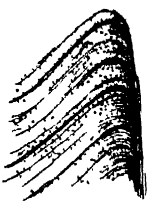

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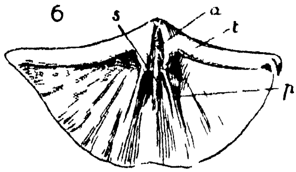

Punctospirifer northi, sp. n.

Fig. 3.—Brachial valve showing broad median fold and curved costæ on the lateral slopes. Paratype. Museum of Practical Geology [37979]. Natural size.

Fig. 4.—Pedicle-valve showing broad median sinus. Holotype. M. P. G. [37978]. Natural size.

Fig. 5.—Details of ornament showing punctæ and irregularly developed concentric lamellæ. M. P. G. [37978]. × 3.

Fig. 6.—Interior of pedicle-valve drawn from rubber impression in British Museum (Nat. Hist.) [B. 47349], and taken from an internal cast in Museum of Practical Geology [37980]. Median septum (*s.*), hinge-teeth (*t.*), apical callosity (*a.*), delthyrial supporting plates (*p.*). Paratype. Natural size.

Brachial valve (specimen no. 37979) 24·5 mm. long, 42 mm. wide, 11·5 mm. thick ; slightly convex, with a rounded prominent median fold, which at the anterior margin is about three times the width of the bounding costæ. There are six or seven rounded costæ on each lateral slope ; at the umbo there are five costæ as well as the median fold. The costæ are crossed by concentric growth-lines,

forming an irregular lamellar ornament. The interior of the brachial valve is unknown.

Type-specimen.—Holotype, no. 37978, Museum of Practical Geology, London. Paratypes, British Museum, B. 47306–07, two pedicle-valves. Museum of Practical Geology, 37979, 37980, Tm. 50, seven pedicle and two brachial valves.

Remarks.—The irregular external ornament of *P. northi*, the thickening of the shell, and the small apical callosity in the pedicle-valve are phylogerontic characters. Besides the congeneric *P. scabricosta*, North, which occurs at a lower horizon (S_2–D_1), *P. northi* resembles *Tylothyris laminosa* (M'Coy), but can be at once distinguished by its punctate shell. It may be distinguished from all species of *Spiriferina* by the differentiation of its hinge-line from the lateral slopes, by the great width of the hinge, by the subangular cardinal extremities, and by the more numerous costæ on the lateral slopes.

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XXXI.—*An Acephalous Larva of a Nematocerous Dipteron: the Early Stages of* Canthyloscelis (*Diptera*, Scatopsidæ). By A. L. Tonnoir, Canterbury Museum.

One of the most remarkable genera of Diptera of New Zealand is without any doubt *Canthyloscelis*, which was erected a few years ago by F. W. Edwards * to receive three New Zealand species and which he included in the family Scatopsidæ.

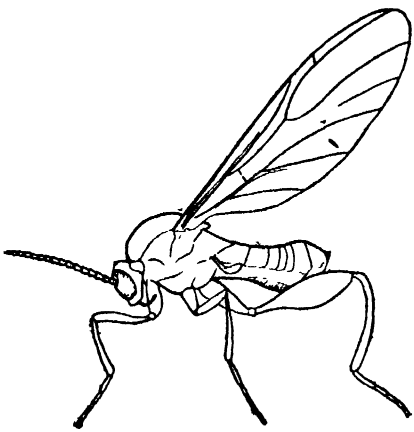
* Ann. & Mag. Nat. Hist. (9) vol. ix. 1922, p. 267.

Fig. 1 gives an idea of this peculiar fly, which is distinguished at once by the very swollen hind femora and curved hind tibiæ as well as by the club-shaped abdomen. According to Edwards, the nearest relative of these Diptera belongs to the genus *Corynoscelis,* which they resemble chiefly in wing-venation and the conformation of the hind legs.

These insects are not by any means common, and seem only to occur singly and in the damp forest; therefore I considered myself very fortunate when I discovered the early stages of *Canthyloscelis* within the first month of my stay in New Zealand.

When camping on the Mt. Arthur Plateau (4500 feet), in the Nelson district, and searching for larvæ in rotten

Fig. 1.



Imago of *Canthyloscelis antennata,* Edw.

logs, I came across a dipterous pupa that I could not readily identify—nor, indeed, connect with certainty to any dipterous family,—and I awaited therefore the emergence of the adult with great interest. This pupa was just below the surface of the log, and did not seem placed in any niche, but right in the wood and apparently at the end of a gallery. The log was in a rather far advanced state of decay, and had practically no bark left; it was very likely the log of some southern beech (*Nothofagus* sp.), of which the bush near the camp was mostly composed.

The pupa was found on the 22nd of December and the fly emerged on the 3rd of January; as it was, when collected, nearly as dark-coloured as during the last days, it must have

been then in that stage for some time, and I presume that the pupal stage lasts well over a fortnight.

The pupa showed attached to the last segments the dry shrivelled skin of the larva, and a superficial examination under the binocular led me to believe that the head-capsule of the larva was lost, as I could not but think that this larva

Fig 2.

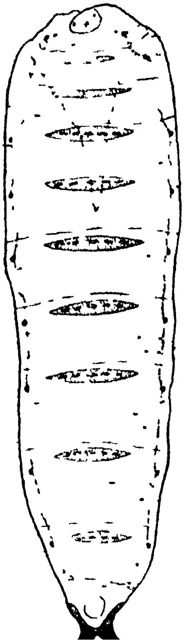


Fig 3.

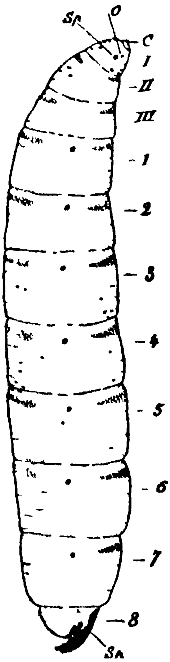


Fig. 4.

Fig. 5.

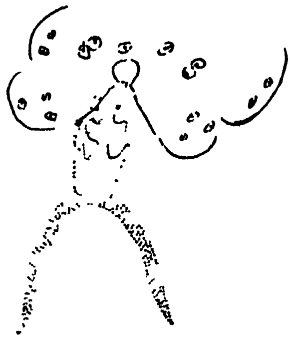


Fig. 2.—Exuvium of larva of *C. antennata* as seen on a slide with cover-glass.

Fig. 3.—Reconstruction of the larva of *C. antennata* from exuvium shown in fig. 2 · *C.*, cephalic segment; *Sp.*, spiracles; *O.*, organ of the first thoracic segment.

Fig. 4.—Cephalic segment of the larva of *C. antennata* as seen on the slide.

Fig. 5.—Mouth-opening and internal mouth-parts of the larva.

should be eucephalic, the fly exhibiting evident relationship with the Scatopsidæ or the Bibionidæ.

But in the meanwhile appeared Edwards's note erecting a new genus and placing it among the Scatopsidæ ; this prompted me to take up the matter again, because my

previous experience with Scatopsid larvæ had taught me that their larvæ and pupæ were of very different aspect.

After having made a drawing of the pupal skin with the larval exuvium attached to it (see fig. 7), I put it to soak and then boiled it down in caustic potash solution—this allowed the larval skin to be detached and unfolded; when extended and placed on a slide with a cover-glass it appeared as shown in fig. 2. To my great surprise I saw then that the cephalic segment had not been lost, but that it was exceedingly small, not more chitinous than the rest of the body, and that its appendages were either missing or discernible only under a high power.

To obtain the approximate original shape of the larva I filled this empty skin with a suitably shaped glass rod; this allowed me to draw fig. 3, which I consider to be a fairly accurate reconstruction of the larva. However, this did not satisfy me entirely, and I have kept a sharp look-out for this larva during several years of collecting, but so far without any success. Now I begin to think that the possibility of finding other larvæ of this genus is rather remote, and that on account of the unusual interest of this larva it is better to give now an account of the results so far obtained.

The chief point of interest in the larva of *Canthyloscelis* is that it differs very widely from those of any known Scatopsidæ or Bibionidæ by the absence of a true head-capsule, a fact which seems at first sight to point to a strong affinity with the Cecidomyiidæ; but the question of affinities will be discussed after the description of the early stage.

Canthyloscelis antennata, Edw.

LARVA :—

Body: apparently composed of eleven segments, besides the very diminutive head or cephalic segment; shape subcylindrical with both ends attenuated, but much more so anteriorly.

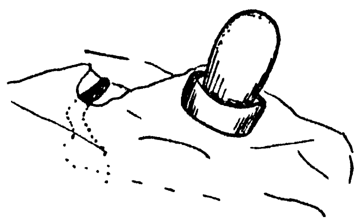
Head very much reduced in size (fig. 4) and analogous to that of cyclorrhaphous Diptera larvæ; its integuments do not differ from those of the rest of the body; there is therefore no head-capsule, but a cephalic segment. The mouth-parts are completely atrophied; one distinguishes only a very small mouth-opening (fig. 5) surrounded by papillæ placed on little protuberances and an internal, very weakly chitinous, armature composed of two parts: the anterior one which may be the pumping organ of the pharynx, and the second, which follows it, a horseshoe-shaped slightly more chitinous

structure, the function of which does not seem clear to me—it is perhaps the collar of the œsophagus.

On each side and above the mouth-opening are placed the antennæ; they are very small, yellowish brown, and rather chitinous, and offer therefore a marked contrast with the rest of the integuments; they are composed of two segments: a basal annular one and an apical rounded one, which is only a little longer than wide. Near each antenna, on the internal side, is to be found a peculiar organ (fig. 6), to which I know nothing analogous in dipterous larvæ; it is placed in a small cavity of the cephalic segment, and the part that is lodged in that cavity or pit is chitinous and apparently of the same consistency as that of the antennæ; the internal part is less discoloured and is curved on one side; the remains of a duct or a nerve seem to be attached to its end there.

Thorax: The three thoracic segments are little developed

Fig. 6.



Antenna and enigmatic organ of the larva.

as compared to the rest of the body. The first segment carries the first pair of spiracles, which are strongly chitinous and assume the shape of a short cylinder; they are the same size as those of the abdomen. Near each of these prothoracic spiracles, on the dorsal internal side, there is a small roundish chitinous piece (*O.*, fig. 3), a little smaller than the spiracle itself; it has the shape of a yellow funnel when seen in profile, but there is apparently no lumen at the bottom, which is, however, somewhat more transparent than the rest. There remains no trace of duct or cord of any kind attached to the organ, whereas the spiracle shows still a good length of trachea in its prolongation; it seems therefore that this chitinous piece has nothing to do with the respiratory system.

The thoracic segments II. and III. do not bear spiracles, but are provided dorsally and ventrally at their anterior border with a lozenge-shaped area which is covered with

microscopical spinules directed backward—these areas containing no space devoid of spinules.

Abdomen: The six following abdominal segments are also provided each with a dorsal and ventral spinulose area, but these contain some empty roundish spaces devoid of spinules; the ventral areas contain six, or sometimes five, such empty spaces, whereas the dorsal areas, which are rather elongated and somewhat narrower in their middle, contain only two such empty spaces placed at both ends of the area. Abdominal segment 7 lacks the dorsal spinulous band and there are none on segment 8.

It will be remembered that the description of this larva is made from the larval exuvium only; it is therefore impossible to decide with certainty if the segments offer in life a swelling or protuberance where the spinulous areas are situated, as often occurs in dipterous larvæ; but if there are any such swellings there, they must be very little developed, as the empty skin does not show any noticeable creases in their vicinity.

The abdomen is apparently composed only of eight segments; the first seven are nearly subequal, but the eighth is noticeably smaller and ends in a strongly chitinous brown fork; this last segment may be in reality formed by the eighth and ninth abdominal segments, but there is no trace of segmentation whatever there, whereas the limit between the other segments of the body is quite easy to make out, on account of the presence of a circle of small dots which are in all probability the points of insertion of the muscles.

The abdominal spiracles are present on each of the eight segments; they are all of the same size and shape, and even the last pair does not differ from the others; they are placed on the side of the first seven segments and at about the first quarter of their length; the last pair is situated more dorsally and distally, just at the base of the terminal fork.

This terminal armature, as shown in fig. 2, has its sides prolonged forward, whereas the two horns are curved dorsally and are provided with a small blunt protuberance placed in their concavity; the anus is lodged between the lateral prongs of this armature and is surrounded by a narrow chitinous brownish ring.

Pupa (fig. 7):—

Length 6 mm., width $1\frac{3}{4}$ mm. Subcylindrical, stout, relatively short; its teguments brownish red, strongly chitinous; all the appendages closely applied to the body

and fused intimately to it, as is usual in a pupa obtecta. The prothoracic spiracles not pedunculate, but more or less ear-shaped and very small (fig. 8).

Fig. 7.

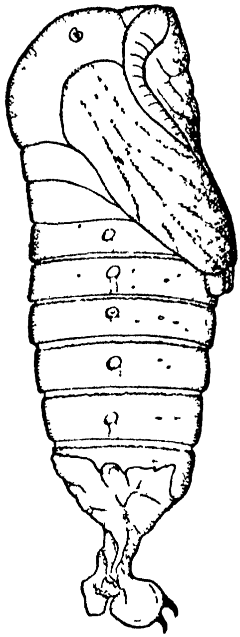


Fig. 8

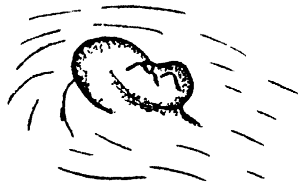


Fig. 9.

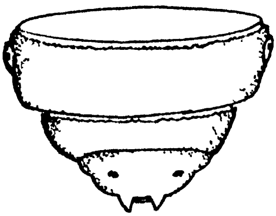


Fig. 10

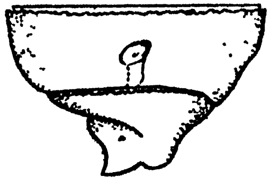


Fig. 7.—Pupa of *C antennata* with larval exuvium attached.
Fig 8.—Thoracic spiracle of the pupa.
Fig. 9 —Last segments of pupa, dorsal view.
Fig. 10.—Last segments of pupa, in profile.

The abdominal segments 3 to 7 are perfectly cylindrical and like the second carry on each side a button-shaped little-protruding spiracle, under which there is a small swelling that reaches the posterior border of the segment.

The last segment (figs. 9 & 10), seen dorsally, seems divided in two by a transversal fold, no trace of which exists on the ventral side : this segment carries at the apex two little dorsal horns, relatively much less developed than the larval ones, and above which are placed the two very small spiracles which may not be functional. The dorsal and ventral faces of segments 2 to 7 show a certain number of small foveoles regularly arranged.

Compared to the early stages of *Scaptopse* we find that the larva of *Canthyloscelis* differs from that of *Scatopse* as follows :—

1. Absence of head-capsule and nearly complete atrophy of mouth-parts.
2. Body composed apparently of eleven and not twelve segments.
3. Integuments soft and thin, apparently colourless and not tough, thick, strongly discoloured and provided with strong hairs and granulations.
4. Body subcylindrical, not flattened ventro-dorsally.
5. Spiracles button-shaped, not in form of little tubes.
6. All the spiracles of the same size and structure, the last pair not placed at the extremity of rather long and strong horns.
7. The last pair of spiracles placed right at the extremity of the body and not on the posterior border of the penultimate segment.
8. Terminal armature of the body formed of a single piece carrying the two horns and not composed of two isolated pieces.

The pupa of *Canthyloscelis* differs as follows from that of *Scatopse* :—

1. Body nearly completely free from the larval skin and not completely enveloped in it.
2. Shape cylindrical, not flattened dorso-ventrally.
3. Anterior spiracles button-shaped, very little developed, not elongated as bi- or multi-branched horns.
4. Lateral spiracles button-shaped, not protruding from the body and not in form of elongate thin little tubes which emerge from the pupa only after metamorphosis.
5. A pair of small spiracles on the last abdominal segment, whereas in *Scatopse* there is no trace of spiracles on the last two segments, the number of pairs being six and not seven as in *Canthyloscelis*.

Compared to *Bibio* larva, that of *Canthyloscelis* differs as follows :—

1. Head-capsule absent.
2. Body composed of eleven segments and not twelve.
3. Segments of the thorax comparatively small; the first one smaller and not longer than the others and not apparently composed of two parts.
4. Integuments thin and smooth and not provided with granulations and spiny processes.
5. Nine pairs of spiracles and not ten ; that of thoracic segment III. absent.
6. All the spiracles of the same size; the last pair not larger.
7. A horny armature at the end of the body which does not exist in *Bibio*.

The pupa differs from *Bibio* pupa as follows :—

1. Absence of spiny armature on body or the head.
2. Pupa not completely free from the larval skin.

Compared to Cecidomyiid larvæ, that of *Canthyloscelis* differs as follows :—

1. The number of segments of the body is eleven and not twelve.
2. Absence of any rudiment of cephalic armature, internal or external.
3. Presence of horny armature at end of the body.

The pupa differs more widely than does the larva by :—

1. The absence of prothoracic breathing horns.
2. Eight pairs of spiracles and not nine.
3. All appendages fused completely with the body (pupa obtecta) and not more or less free from it (pupa libera).

It results from these comparisons that the affinity of the larva of *Canthyloscelis* seems to be greater with the larvæ of the Cecidomyiidæ on account of the atrophy of the head-capsule, the soft cylindrical body with spinulous areas on some segments for ambulatory purposes, and the similar tracheal system ; however, the cephalic segment of *Canthyloscelis* is more of the type of that of a cyclorrhaphous dipteron and shows therefore a greater degree of atrophy than that of the Cecidomyiidæ, the anterior part of which is more chitinous than the rest of the body.

On the other hand, the affinity of the pupa of *Canthyloscelis* is greater with that of some Mycetophilidæ, like *Mycomyia*, but among the Bibionoidea its nearest relative seems to be that of *Bibio* on account of its general structure, the nature of the integuments, and the absence of prothoracic breathing horns.

I will note again here that the most essential points in which the pupa of *Scatopse* differs from that of *Canthyloscelis* is that it is completely surrounded by the larval skin and that its breathing horns, at least those of the abdomen, emerge from the pupa only after it is formed, when they pierce the old larval skin *.

It will thus be seen that both larva and pupa of *Canthyloscelis* have practically nothing in common with those of the Scatopsidæ (so far as known), to which the imago seems undoubtedly to belong. This is another puzzling problem of the early stages of Diptera.

Addendum by F. W. Edwards.—Mr. Tonnoir has kindly allowed me to read the manuscript of the above paper, and has invited me to express an opinion upon the relationships of *Canthyloscelis* from the point of view of adult morphology. I will only remark that as in the larva, so in wing-venation, the genus differs very much from most other Scatopsidæ, as well as from Bibionidæ and Cecidomyiidæ. The venation of *Canthyloscelis* is difficult to interpret, especially as regards the radius and media, the latter vein being very much modified and its original connections lost. It is quite clear, however, that the vein Cu_1 (Tillyard's M_4) is present, while in *Scatopse*, *Aspistes*, *Forbesomyia*, etc., it is lost, *Cu* being a simple vein. In this respect, as well as in the possession of a strong cross-vein towards the base of the wing, *Canthyloscelis* resembles the European genera *Corynoscelis* and *Synneuron*. On account of these and other peculiarities, I would suggest including these three genera in a separate subfamily, the Corynoscelinæ. As to whether this group is correctly located in the Scatopsidæ, or is nearer to the Bibionidæ or Cecidomyiidæ, further evidence is desirable.

* Tonnoir, "Larve et nymphe de *Scatopse subnitens*," Ann. Soc. ent. Belg. 1926.

XXXII.—*Some Sarcophagid Flies (Diptera) from the South Pacific Islands.* By Prof. MARIO BEZZI, Turin, Italy.

THROUGH the courtesy of Dr. P. A. Buxton I have received for study a small but interesting collection of Sarcophagid flies from Samoa and other Pacific Islands. They were in great part already determined by Dr. J. M. Aldrich, of the U.S. National Museum, Washington, D.C., U.S.A., who had also spread the genitalia of most of the specimens.

I have completed the study by comparison with material from Fiji Islands received from the Imperial Bureau of Entomology. The results are as follows:—

1 (6). Wings strongly yellow at base and with bright yellow veins; calypters orange-yellow and with golden fringe exteriorly at base; second abdominal segment with strong bristles in middle of hind border; abdominal sternites bristly even in male; propleura and prosternum bare.

2 (3). Bristles of parafacials weak; occiput with three deep black spots; hind tibiæ of male with a well-developed fringe; third and fourth abdominal segments in both sexes shining black, very slightly dusted, without checkerings .... *ganura*, sp. n.

3 (2). Parafacial bristles strong; occiput with a central black spot only: hind tibiæ of male less or not at all fringed; third and fourth abdominal segments well dusted.

4 (5). Thorax and abdomen grey-dusted, even if rather slightly on the two last abdominal segments; beard whitish; hind tibiæ of male with weak fringe . *tephrura*, sp. n.

5 (4). Thorax and abdomen with golden dust, the last two abdominal segments densely dusted, beard orange; hind tibiæ of male quite bare.......... *chalcura*, sp. n.

6 (1). Wings not or very little yellow basally, with black veins; calypters white and with white fringe; hind margin of second abdominal segment destitute of bristles; abdominal sternites of male without bristles.

7 (8). Fourth abdominal segment in both sexes reddish and clothed with golden dust; occiput black; frontal stripe in both

sexes more narrow than one of the parafrontalia; parafrontalia and parafacialia with golden dust, but the face quite black; parafacialia almost bare, with only a few hairs below near the eyes; propleura and prosternum bare or nearly so; metapleura with a few hairs; anterior dorsocentrals well developed; one pair of strong prescutellar acrostichals; three sternopleurals; third abdominal segment without bristles at hind border . *peltata*, Aldrich.

8 (7). Fourth abdominal segment quite black and without golden dust; frontal stripe as broad as, or broader than, one of parafrontalia; face always grey or whitish.

9 (12). Only two sternopleurals, at least in male; prosternum and propleura densely pilose; parafrontalia and parafacialia of male conspicuously golden-dusted.

10 (11). Wings strongly infuscated; parafacialia quite destitute of bristles or hairs; no distinct prescutellar acrostichals; superior claspers of male genitalia with a strong preapical angle; penis without long appendages .. .. *rhynchura*, sp. n.

11 (10). Wings quite hyaline; a row of parafacial bristly hairs; one pair of weak prescutellar acrostichals; superior claspers gradually attenuated; penis with long cirrhiform appendages .... *cirrhura*, sp. n.

12 (9). Three sternopleurals; prosternum and propleura bare or nearly so; parafrontalia and parafacialia grey or whitish, never conspicuously golden.

13 (14). Palpi distinctly reddish or quite yellowish; postocular cilia in but one row; parafacialia with many rows of hairs; two strong postsutural dorso-centrals and one acrostichal; metapleura bare . *orchidea*, Böttcher.

14 (13). Palpi quite black.

15 (18). Postocular cilia in but one row; ocellars strong; hind tibiæ fringed; superior claspers regularly acute.

16 (17). Superior claspers gradually attenuated to the end .... *dux*, Thomson.

17 (16). Superior claspers with a thin spiniform process at end .... *froggatti*, Taylor.

18 (15). Postocular cilia in 2–3 rows; ocellars thin; hind tibiæ quite bare; superior claspers with a small point at end .. *fuscicauda*, Böttcher.

The following three new species (*ganura*, *tephrura*, and

chalcura) form a group with *flavinervis*, Senior-White *, and belong to the species which may be safely determined without examination of genitalia ; they are characterized by the wings being strongly yellow basally, by the wing-veins being bright yellow at base, and by the orange-yellow calypters. With these species may be placed even the South African *S. elegantipes*, Villeneuve †, which is, however, very different in the legs, in the abdominal pattern, and in the male genitalia; moreover, in this species the lower calypter is broadly whitish on the posterior half, chiefly in the female, while in the Indo-Australian species it is entirely orange-yellow. The Oriental *flavinervis* is different from the Pacific species in the distinctly lineate abdomen and in the want of bristles at hind border of second abdominal segment.

(1) *Sarcophaga ganura*, sp. n., ♂ ♀.

Distinct from *flavinervis* because the parafrontalia and parafacialia are not dusted with gold, and also by the very different coloration of the abdomen, which has, moreover, a pair of strong median bristles on the second segment.

The characters given in the key are sufficient for distinguishing the present species, the types of which from the Fiji Islands are in the British Museum. A complete description will be given in my forthcoming work on the Diptera of Fiji.

(2) *Sarcophaga tephrura*, sp. n., ♂ ♀.

Very near the preceding, but distinguished by its smaller size, by the presence of strong parafacials, by the absence of deep black spots at sides of occiput, and by the more dusted apical half of abdomen. This species is also from the Fiji Islands and to be described in the above-mentioned work ; one additional female from Suva, Fiji, 23–25 December, 1925 (*G. H. E. Hopkins*). Types in British Museum.

* "A Revision of the Subfamily Sarcophaginæ in the Oriental Region," Records of the Indian Mus. xxvi. 1924, p. 229, pl. viii. and pl. xvii.

† "Descriptions de Tachinaires Africains nouveaux," Revue Zool. Afric. ix. 1921, p. 31.

(3) *Sarcophaga chalcura*, sp. n., ♂ ♀.

Distinguished from the two preceding species by the bright golden colour of the dust of the thorax and abdomen.

Types, ♂ and ♀, in the British Museum, from Hog Harbour, Espiritu Santo, New Hebrides, July–August 1925 (*P. A. Buxton*).

Length of body 9–10 mm., wing 7–8 mm.

Male.—Occiput entirely clothed with golden dust, with a rectangular, deep black spot in middle just above the neck; hairs orange, more dense and long below; setæ black, the postoculars disposed in one complete row, but above there is the beginning of a second row. Frons at vertex about half as broad as eye, but gradually widened anteriorly; the deep black middle stripe as broad as one of the parafrontalia, which are golden-pollinose and bare, with a row of 6–7 black cilia near the eyes; ocellars small; no distinct outer sternite; frontals descending to the end of second antennal joint. Eyes bare, with equally small facets, of oval shape, the vertical diameter being twice as long as the horizontal one. Antennæ inserted above the middle of eyes, entirely black; third joint four times longer than the second, reaching nearly to the vibrissæ; arista longer than the whole antenna, with long plumosity at base, broadly bare at end. Parafacialia golden-pollinose, as broad as the third antennal joint, with 2–3 rather strong, black, bristly hairs below near the eyes; facial ridges shortly ciliated to the middle; face concave, not carinate, golden-grey, edge of mouth only slightly prominent; vibrissæ strong and long, decussate, below them 6–7 minor bristles; peristomialia only a little broader than the parafacialia, with golden dust and short golden hairs; back of head with dense golden hairs. Palpi deep black; proboscis short, black. Thorax and scutellum golden-pollinose, with three complete, equally narrow, black stripes, the middle one prolonged on scutellum but not reaching hind border; there is, moreover, a narrow black line on notopleural suture; pleuræ grey-pollinose, with golden patches on humeri, on meso-, ptero-, and sternopleuræ. Mesophragma dusted with grey, postscutellum black, not highly developed. All the hairs and bristles of back and pleuræ black; propleura, prosternum, and metapleura bare; postsutural dorso-centrals 3–4 and two presutural dorso-centrals; anterior acrostichals differentiated only in front, and one pair of prescutellar ones; two intra-alars; one propleural and one just below the black

anterior spiracle; three sternopleurals on the same line; mesopleural row with 5–6 bristles; pteropleura with a tuft of short bristles above; hypopleural row with 8–10 strong black bristles. Scutellum with three marginals, one subapical pair and none apical. Calypters dark orange, with whitish hind border, the lower one bare on disc, more than twice longer than the upper, with short golden fringe exteriorly at base. Halteres orange-yellow. Abdomen golden-pollinose on back, grey on venter; it is less distinctly tessellated than in most species; each segment with a narrow black hind border, the second and third with a complete, narrow, black middle stripe. All the hairs and bristles black; first segment with lateral bristles only; second with a strong middle pair; third and fourth with a marginal row of about a dozen. All the sternites with bristles at hind border. Last segment of hypopygium reddish; genitalia very different from those of *flavinervis*, with reddish superior claspers, which are black at end, curved and tapering, with sharp end, clothed with short bristly hairs exteriorly; penis black, rounded at end; basal hooks black. Legs quite black, including hairs and setæ; femora grey pollinose on outer side, without combs; hind femora with strong bristles below; tibiæ not fringed; pulvilli yellowish; four anterior claws truncate. Wings greyish-hyaline, with strongly yellow base to the third vein and to beyond middle; veins orange-yellow, a little infuscated at end. Costal spine very small; tegulæ and rest of costa yellowish; first vein bare; third vein hairy above nearly to cross-vein, with only 2–3 hairs below at node; third costal segment about as long as the fifth; first posterior cell rather narrowly open; appendix of bend spurious; hind cross-vein oblique and S-shaped; sixth vein not reaching hind border.

Female.—Very like the male, but the frons about as broad as eye, outer verticals present, claws of anterior legs acute, long, curved; genitalia black, almost concealed.

(4) *Sarcophaga peltata*, Aldrich, 1916, p. 216.

Numerous specimens of both sexes referred by Dr. J. M. Aldrich to this West Indian species; they should perhaps be referred to *Sarcophaga taitensis*, Schiner, 1886, p. 314, from Tahiti, and they are probably different from the Neotropical form, even if very closely allied. The face is quite

black, while in American specimens it is broadly greyish in middle.

Apia, Upolu, 1924, 1925 (*P. A. Buxton* and *G. H. E. Hopkins*), bred from human fæces, horse-dung, etc.; very common, but probably imported.

The present species is very different from all the others here recorded, requiring possibly the separate genus already erected by Dr. C. H. T. Townsend* under the name of *Oxysarcodexia*.

The two following new species (*rhynchura* and *cirrhura*) seem to belong to a peculiar endemic group, characterized by the presence of only two sternopleural bristles and by the densely pilose prosternum and propleura. Unfortunately, there are no known females of this group; possibly they have three sternopleurals and less pilose prosternum:—

(5) *Sarcophaga rhynchura*, sp. n., ♂.

Very distinct on account of its golden-dusted parafrontalia and parafacialia, by the complete lack of parafacials or of prescutellar acrostichal bristles, by the strongly infuscated wings, and by the peculiar superior claspers.

Type ♂ (Bishop Museum, Honolulu) and some additional specimens of same sex from Salailua and Lafune, Savaii, Samoa, lowlands to 1000 ft., May 1924 (*E. H. Bryan, jun.*).

This species seems to be allied with *phœnicopterus*, Böttcher, from Formosa, and with *beesoni*, Senior-White, from Upper Burma.

Length of body 12–14 mm., wing 10–12 mm.

Male.—Occiput black, dusted with dark grey at sides below, with yellowish-dusted ocular body, except superiorly, where it is rather shining black; postocular cilia disposed in but one row; hairs black superiorly, pale yellowish below. Frons at its narrowest part about one-third of eye, but much broadened in front; at level of antennæ half the width of eye; parafrontalia golden-dusted, with a few scattered black hairs on upper part; middle stripe black, somewhat reddish brown, parallel-sided, broader than one of the parafrontalia; frontal bristles reaching only to the middle of second antennal joint; one pair of long preverticals, directed

* "Genera of the Dipterous Tribe Sarcophagini," Proc. of the Biol. Soc. of Washington, 1917, xxx. pp. 191 and 195.

backwards; outer verticals not distinct; ocellars small. Eyes bare, oval, with the anterior middle facets distinctly, though slightly enlarged. Antennæ inserted above middle of eyes, black, with greenish third joint, which is about four times as long as the second, reaching to the vibrissæ; arista longer than the whole antennæ, with scattered plumosity, only the last fourth being bare. Parafacialia dusted with gold, a little broader than the third antennal joint, bare, quite destitute of hairs or bristles; face yellowish-dusted; facial ridges ciliated to the middle; 4–5 bristles below the vibrissæ; peristomialia golden-dusted, as broad as one-third of eye, clothed with yellowish hairs, which are denser and longer on back of head. Palpi and proboscis black. Thorax on back grey-pollinose, with three broad, equal, parallel, black stripes, the middle one continued as a broad patch on scutellum. Pleura grey-dusted, with a black stripe below the notopleural line; hairs and bristles black; no acrostichals, even before scutellum; only two postsutural dorso-centrals, no presuturals; only one strong intra-alar; one propleural and one stigmatal; 3–4 mesopleurals; only two sternopleurals, the middle one absent; a tuft of small pteropleurals; 8–20 hypopleurals long and thin; anterior spiracle dark yellowish; propleura and prosternum densely pilose; metapleura pilose. Scutellum with two laterals, one small apical, no preapical. Mesophragma shining black, dusted with grey, calypters white, the lower one bare, twice as long as the upper, with white fringe at sides anteriorly; halteres yellowish; posterior spiracle yellowish. Abdomen elongate, black, rather shining, with broad, rounded, white pollinose patches at sides of second, third, and fourth segments, and with another pair of smaller ones between them, but not forming true checkerings. Hairs black, like the bristles; first and second segments with laterals only, third with a middle pair, fourth with a complete row of about ten. Venter dusted with grey all over, the broad sternites with somewhat reddish margins, with whitish hairs, but without bristles. First genital segment black, dusted with grey at hind border, with black hairs but without bristles; second genital segment shining black, with a long tuft of dense black hairs; superior claspers shining black, broad, with a rounded prominence before end, suddenly narrowed into a long curved point; sixth sternite margined with strong, dense, black bristles. Legs entirely black, the femora dusted with white at the outer side of the base; coxæ with dense yellowish dust;

femora without comb, the hind femora with strong bristles below and to the outer side; hind tibiæ with long, dense, complete, black fringe; middle tibiæ only with terminal fringe; anterior claws truncated; pulvilli yellowish. Wings strongly infuscated to beyond middle, being hyaline only at apex and at hind border, the infuscation more intense along the veins, forming sometimes dark stripes. Tegula and base of costa yellowish; veins black to the extreme base; no costal bristle; first vein bare; third setose above about as far as the small cross-vein, and below with 2–3 bristles at node only; third segment of costa about equal to the fifth; bend at acute angle, the apical cross-vein very concave beyond it, first posterior cell rather broadly open; appendix spurious; hind cross-vein S-shaped, but less oblique; sixth vein not reaching hind border.

(6) *Sarcophaga cirrhura*, sp. n., ♂.

Closely allied to preceding species on account of the presence of only two sternopleurals, but distinguished by somewhat smaller size, not infuscated wings, distinct parafacials and prescutellars, and very different superior claspers.

Type, ♂, in British Museum from Apia, Upolu, Samoa, August 1925, *ex* dead rat (with puparium) (*P. A. Buxton* and *G. H. E. Hopkins*); additional specimens of same sex from Safune, Savaii, Samoa, May 1924, lowlands to 1000 ft. (*E. H. Bryan*); Siumu, Upolu, W. Samoa, February 1923 (*J. S. Armstrong*).

This species appears to be allied to *Sarcophaga caudagalli*, Böttcher, from Formosa.

Length of body 11–12 mm., wing 9–10 mm.

Male.—Head as described for preceding species, but the occiput clothed with denser grey dust and with the postocular border yellowish-dusted to the vertex; the third antennal joint distinctly shorter, only three times as long as the second; the parafacialia inferiorly with a row of bristly hairs near the eyes; the peristomialia a little narrower. Thorax as in preceding, but the three black stripes distinctly narrower; one pair of thin but distinct prescutellar acrostichals; a small third pair of postsutural dorso-centrals in front of the anterior pair of stronger ones; scutellum with a distinct pair of preapicals. Calypters, halteres, and abdomen as in preceding, but the latter more abundantly grey-dusted and with more distinct checkerings, without shining black central part. Superior claspers thin, long, gradually attenuated; penis at apex with long cirrhiform

appendages; the superior claspers gently curved, clothed exteriorly with thin, rather long, spiniform hairs; they are rather obtuse at end, with a short spine superiorly. Legs and wings as in preceding, but the latter not infuscated, or only a little so at extreme base, not beyond the root of third vein and the basal cross-veins.

(7) *Sarcophaga orchidea*, Böttcher.

Distinct from all the other species here recorded on account of the reddish or yellowish palpi, and of the several rows of hairs on lower part of parafacialia.

Considered by Mr. Senior-White as a variety only of the Ethiopian *hirtipes*, Wied.; widely spread throughout the Oriental Region and New Guinea; I have Philippine specimens determined by Dr. Parker.

One female from Malekula, New Hebrides, June 1925 (*P. A. Buxton*); two females, Safune, Savaii, Samoa, and Pago Pago, Tutuila, April–May 1924, lowlands to 1000 ft. (*E. H. Bryan, jun.*).

(8) *Sarcophaga dux*, Thomson.

I have received this widely-spread form (*harpax*, Pand., *subtuberosa*, Parker) from Fiji Islands and from Apia, Upolu, Samoa (*P. A. Buxton* and *G. H. E. Hopkins*).

(9) *Sarcophaga froggatti*, Taylor (=*knabi*, Parker, both 1917, but the former having a few months' priority *).

Widely spread throughout Oriental Region and Australia.

Apia, Upolu, Samoa, bred from horse-dung (*P. A. Buxton* and *G. H. E. Hopkins*).

Tyler Townsend † has erected the genus *Glaucosarcophaga* for a different species, the American *villipes*, v. der Wulp, Aldrich.

(10) *Sarcophaga fuscicauda*, Böttcher.

Widely spread in Orient and Australia.

I have seen it from the Fiji Islands and from Apia, Upolu, Samoa, March 1925, bred from human fæces (*P. A. Buxton* and *G. H. E. Hopkins*).

* T. H. Johnston and O. W. Tiegs, "New and little-known Sarcophagid Flies from South-Eastern Queensland," Proc. of the R. Soc. of Queensland, xxxiii. 1921, p. 76.

† "New Genera and Species of American Muscoid Diptera," Proc. Biol. Soc. Washington, 1917, xxx. p. 45.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

November 3rd, 1926.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

The following communication was read:—

'Jurassic Chronology: III.—Some Faunal Horizons in Cornbrash.' By Sydney S. Buckman, F.G.S.

A few words of introduction show that the phenomenon of faunal dissimilarity within strata of a supposedly synchronous time-unit, the Cornbrash, had been observed about 70 years ago, but had not been understood. These remarks are followed by a short historical summary as to what had been done in the dating of the British Cornbrash, continued by proposals for a series of stratigraphical terms.

A fuller chronology of the Cornbrash is attempted, based on a series of faunal analyses of the Brachiopod species south of the Humber. Such analyses, placed diagrammatically in relation to an overriding stratum of Oxfordian date, disclose a series of synclines, anticlines, and various non-sequences in the strata of the South Humbrian Cornbrash.

The Ammonoid horizons of the Cornbrash are then considered, and the divisions of Cornbrash time on the basis of Brachiopods and of Ammonoids are compared. Further, the Cornbrash and the Inferior Oolite are compared on these bases, and the conclusion is reached that, either the Cornbrash Brachiopoda must have evolved three or four times more rapidly than those of the Inferior Oolite, or else that, if the time-value of Brachiopod species be the same in the Cornbrash as in the Inferior Oolite—and there is every reason that it should be—then the Cornbrash must have taken in deposition a time far in excess of that of the Middle and Upper Inferior Oolite, with all its numerous Ammonoid hemeræ.

The persistence of the Cornbrash and its relation to questions of palæogeographical cartography are then considered, followed by remarks on straddle- or bridge-formations—deposits of similar character running on to connect two Periods or two Ages without any appreciable break.

November 17th, 1926.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

The following communications were read:—

1. 'The Shineton Shales of the Wrekin District, with Notes on their Development in other parts of Shropshire and Herefordshire.' By Cyril James Stubblefield, Ph.D., D.I.C., F.G.S., and Oliver Meredith Boone Bulman, Ph.D., D.I.C., F.G.S.

In the Wrekin district, the Shineton Shales have been found to represent almost the whole of the Tremadocian succession, as

developed in the Tremadoc district. The following subdivision of the shales in this main outcrop was outlined in an earlier publication,[1] and is here more fully discussed:—

(6) Arenaceous Beds.
(5) Zone of *Shumardia pusilla.*
(4) Brachiopod-Beds.
(3) Zone of *Clonograptus tenellus.*
(2) Transition-Beds.
(1) Zone of *Dictyonema flabelliforme.*

In the smaller outcrops of the shales lying on the west and south-west, only the lower part of the sequence has been identified; thus, in the Stiperstones district the presence of the *D.-flabelliforme* and *C.-tenellus* Zones is suggested, while in the Lawley, Cardington, and Pedwardine areas the *D.-flabelliforme* Zone alone is recognized.

A table is given comparing the succession in Shropshire with that of other Tremadocian areas, and showing notably the wide distribution of *D. flabelliforme* and of the *Shumardia-pusilla* fauna. Close comparison may be drawn with the sequence seen in the St. Tudwal's Peninsula of North Wales, although there the uppermost beds are not yet recognized; with the Swedish development, however, comparison is more complete.

In the Wrekin district a thick mass of shales has been compressed against a north-eastern ridge formed of earlier Cambrian and pre-Cambrian strata, resulting in isoclinal folding with faulting in the north-eastern part of the shale outcrop. In the south-west of the district the shales are less disturbed, except in the immediate neighbourhood of the Church Stretton Fault.

Six new species of trilobites have been established, of which three belong to new genera; descriptions are also given of one new brachiopod and three new Hyolithids.

Among species hitherto unrecorded from these shales are *Obolus (Bröggeria) salteri* Holl, *Boorthis* aff. *wimani* Walcott, *Hyolithus* aff. *aratus* Salter, *Dikelokephalina furca* (Salter), *Apatokephalus serratus* (Sars & Bœck) ? var., and *Hysterolenus törnquisti* Moberg (?) var.

The vertical distribution of the different forms of the fauna of the Shineton Shales is illustrated in a table accompanying the paper.

2. 'The Corallian Rocks of Oxfordshire, Berkshire, and North Wiltshire.' By William Joscelyn Arkell, B.A., F.G.S.

The geology of the Corallian formation in Oxfordshire, Berkshire, and North Wiltshire is described, and subdivisions are established. The relation of the rocks to those of the rest of the South-West of England is considered, with especial reference to the Weymouth area, and a general classification based on the

[1] Proc. Geol. Assoc. vol. xxxvi (1925) pp. 374–76.

South-West is suggested for England as a whole. It is claimed that such a classification admits of the English deposits being correlated with those of Normandy, and so with the Continent in general. The broad outline of this correlation is attempted.

The subdivisions adopted for the English deposits are as follows:—

(5) Upper Calcareous Grit.
(4) *Trigonia-clavellata* Beds.
(3) Osmington Oolite Series.
(2) Berkshire Oolite Series.
(1) Lower Calcareous Grit.

It is particularly emphasized that the Coral Rag is a facies deposit which may occur at any date, and that the use of 'the Coral Rag' as a stratigraphical term is not permissible, its use in the past having led to many mistaken conceptions. The substitution of the term by Blake & Hudleston's 'Osmington Oolite Series,' of which the reefs of a definite age in Oxfordshire, Berkshire, Wiltshire, and Yorkshire, hitherto known as 'the Coral Rag,' are shown to be only a facies, is, therefore, suggested. The local nature of coral-reefs in the South of England is described, and their effects upon the sedimentation and the ecological associations are traced. It is pointed out that coral associations started in Yorkshire at the time of the Lower Calcareous Grit, and migrated southwards during the Corallian epoch, failing to become established in Dorset until the closing phase of the Upper Calcareous Grit.

By a more detailed study of the formation in Oxfordshire, Berkshire, and North Wiltshire, the local importance of the Berkshire Oolite Series is revealed. Its chief feature, the *Trigonia* Beds of Berkshire, are contrasted with the much later *Trigonia* Beds of Dorset, with which they have hitherto been confused. It is shown that, whereas the former belong to the Argovian, the latter must be assigned to the Sequanian, the intervening Osmington Oolite Series undoubtedly representing the Rauracian. It is also shown, not only that the Berkshire Oolites deserve separate recognition as a substage and separate mapping (neither of which they have hitherto received), but also that they are capable of more detailed subdivision, some of the components being recognized on the Dorset coast, where they increase in thickness up to eightfold.

By correlating the various subdivisions in a large number of localities the broad tectonic features by which deposition in this area was governed in Corallian times are shown. The resulting conclusions are seen to conform in a remarkable manner to certain previously published inferences with regard to the ancient axes of weakness in the Southern Midlands.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 111. MARCH 1927.

XXXIII.—*Butterflies from N.W. Yunnan.* By H. T. G. Watkins.

The butterflies taken by Professor J. W. Gregory, F.R.S., and his son, Mr. C. J. Gregory, on their geological expedition to N.W. Yunnan in 1922, promoted by the Percy Sladen Trust, proved to be a valuable addition to the British Museum collection, though but few of the species and races represented are new to science, because Oberthür for more than thirty years had been in profitable correspondence with the French Catholic Mission at Tseku on the Mekong, and had described and figured in his 'Études' the various novelties sent by them. A full itinerary and excellent map are given by the explorers in their published work, 'To the Alps of Chinese Thibet.' Here it must be sufficient to say that they entered Yunnan from Burma by Tengyueh in May, went N.E. across country from Yungchang to Likiang, thence on June 18th N.W. by Weihsi and the Mekong to Atuntze, southwards again in July by the Yangtze and its feeders to Likiang and on to the Tali lake, whence they returned west to Yungchang again in August and reached Burma early in September.

A few additional butterflies taken by Mr. A. G. Lewer in 1921, and by Capt. F. Kingdon Ward on botanical expeditions in 1921 and 1922 in much the same area, are included, and are distinguished by the addition of the collector's name, the year being always 1922 unless stated otherwise.

I have also added within square brackets particulars of the few butterflies taken by the latter explorer in his journey of 1924 to the very interesting region of the Tsangpo gorge in S.E. Thibet.

The notes on the Papilionidæ are nearly all the work of Captain N. D. Riley, and I have had the benefit also of his expert help on various points in my own work, and especially the difficult question of the Delias, though the conclusions there come to are my own.

One new species and ten new forms or races are described, viz., *Melitæa didyma wardi*, *M. sindura yunnana*, *Limenitis cottini* f. *albata*, *Lethe helle gregoryi*, *Palaconympha opalina reducta*, *Callerebia polyphemus* f. *perocellata*, *Loxerebia sylvicola gregoryi*, *Lycænopsis morsheadi gregoryi*, *Chilades yunnanensis*, *Aporia hippia gregoryi*, *Huphina nerissa* f. *prætermissa*. The types and paratypes of all are in the B.M.

Fam. **Acræidæ**.

Pareba vesta vesta.

Papilio vesta, Fabricius, Mant. Ins. ii. p. 14 (1787): [S.E.] China.

7 ♂, 4 ♀, Salween Valley, May 21–29; ♂, Gadsze, Yangtze Valley, June 20, the last the only specimen without black discal markings above.

Fam. **Danaidæ**.

Caduga sita tytia.

Euplœa tytia, Gray, Lep. Ins. Nep. p. 9, pl. ix. fig. 2, ♂ (1844): Nepal.

♂, Jugeh River (trib. Yangtze), 7000–9500 ft., July 27; ♀, Gadsze to Beta, Yangtze Valley, June 22.

Fam. **Nymphalidæ**.

Argynnis lathonia issæa.

Argynnis issæa (Gray, nom. nud.), Moore, Cat. Lep. E. I. C. Mus. i. p. 156 (1857): Bhutan.

♂, Weihsi, 7700 ft., June 28. Not previously in the B.M. from China.

[♂ ♀, Tsangpo gorge, 7000 ft., Dec. 6, 1924 (*Ward*).]

Argynnis eugenia rhea.

♂ ♀. *Argynnis eugenia*, var. *rhea*, Grum-Grshimailo, Hor. Ent. Ross. xxv. p. 456 (1891): N.E. Thibet (Amdo).

♂, Muli, Litang River, 11,000 ft., Aug. 4 (*Ward*).
Not differing from Leech's 9 ♂ from Szechuan.

Argynnis pales palina.

Argynnis pales palina, Fruhstorfer, Iris, xvi. p. 306 (1903): Szechuan (Tatsienlu).

♀, Paimashan, 16,000 ft., Aug. 16 (*Ward*).
A welcome addition to Leech's 6 ♂ from Szechuan.

Argynnis gong charis.

Argynnis charis, Oberthür, Et. Ent. xv. p. 8, pl. i. fig. 4, ♀ (1891): Yunnan.

♂ ♀, Shuantan, 7000–8000 ft., in the valley of Loma River (trib. Mekong), June 4.

Not previously in B.M.

Argynnis cydippe taliana.

Fabriciana taliana, Reuss, Deutsch. Ent. Zeitschr. 1922, p. 196: Yunnan.

♂, on road between Likiang and Weihsi, in June; ♀, N. of Weihsi at 7000 ft., June 27.

Reuss's articles, in which he separates *Argynnis* into genera by an elaborate study of the ♂ androconia, are not for the faint-hearted, and, in my opinion, sexual characters should not be used for generic division. But I believe this pair represent his *taliana*, and for the Szechuan form his *stoetzneri* will be prior to my *leechi* of 1924.

Not previously in B.M.

Argynnis nerippe nerippina.

Argynnis nerippe nerippina, Fruhstorfer, Soc. Ent. xxii. p. 68 (1907): Thibet.

♀, taken in the Mekong Valley near Yeichih, June 29.

Argynnis laodice rudrina.

Argynnis laodice samana, f. *rudrina*, Fruhstorfer, Ent. Zeitschr. Stuttg. xxi. p. 163 (1907): Szechuan (Tientsuen).

8 ♂, 4 ♀, taken at various localities and elevations of usually from 6000–8000 ft., but E. of Atuntze as high as 12,000 ft., from May to the end of July. As Fruhstorfer says, this subspecies links *rudra* from Assam with *samana* from Szechuan.

Not previously in B.M.

Argynnis hyperbius hyperbius.

♀. *Papilio hyperbius*, Johansson, Amœn. Acad. vi. p. 408 (1764): [S.E.] China.

♀. *Papilio niphe*, Linné, Syst. Nat. (ed. 12) i. p. 785 (1767): [S.E.] China.

3 ♂, 2 ♀, taken in the Mekong Valley near Yeichih, at 6200–6400 ft., June 29, 30. A wonderfully constant species; so far as I know, no one has attempted to divide into races the Himalayan form and those from the various parts of China.

Melitæa yuenty.

♂. *Melitæa yuenty*, Oberthür, Et. Ent. xi. p. 17, pl. ii. fig. 13 (1886): Szechuan (Tatsienlu).

11 ♂, 1 ♀, taken in various localities and at very various elevations from 4400 to 11,000 ft., from May to end of July.

Ward also took a ♂ at Muli on the Litang River at 9000 ft., May 30.

Except that they are smaller, they do not differ from Leech's long series from Tatsienlu and elsewhere in Szechuan.

[*Melitæa didyma wardi*, subsp. n.

♀ (type), Gyala, R. Tsangpo, 9000 ft., July 19, 1924 (*Ward*).
♂ (allotype), Truphé, R. Tsangpo, 9800 ft., Aug. 4, 1913 (*Bailey*).
♀ (paratype), Phé, S.E. Thibet, July 13, 1913 (*Bailey*).

Differs from *agar*, Oberthür, from Tatsienlu, Szechuan (Et. Ent. xi. p. 18, pl. v. figs. 32 ♂, 31 ♀, 1886), in the much less extent of the black markings and suffusion in both sexes above; beneath the tawny postmedian bar of hind wing has within it no black spots, in this resembling that of typical *didyma*, though more regular.

On the other hand, the series of præterminal black arrow-heads on the folds between the veins (not the black spots in the fringes) are more distinct.

Bailey took fifty-seven specimens of this race in the same district, mostly between Gyala and Lhapto, at 9000 to 13,000 ft., in July and August 1913, but including a few in the Karpo Valley to the south at 12,000 to 14,000 ft. in September; of these Col. Evans (Journ. Bomb. N. H. S. xxiii. (3) p. 541) states that they are practically identical with Seitz's figures of *agar*, but the pair he has given to the B.M. differ considerably from the long series of *agar* there including paratypes.

The ♀ from Phé, though much darker above and showing orange only on a postmedian band of hind wing agrees on the underside entirely with Capt. Ward's specimen.]

Melitæa sindura yunnana, subsp. n.

♂ ♀. *Melitæa jezabel*, Oberthür, ibid. p, 17, pl. ii. fig. 14 (1886): Szechuan (Tatsienlu).
Melitæa thibetana, Fawcett, Proc. Zool. Soc. Lond. 1904, p. 135, pl. ix. fig. 2: S.E. Thibet (Khambajong).

3 ♂, taken at Shuantan in the valley of the Loma (trib. Mekong) at 7000–8000 ft., June 4.
♂, Yungning, 9500 ft., June 30; ♂, Litang River, Muli, 10,000 ft., June 3; ♀, Litang River, Muli, 9000 ft., July 5 (*Ward*).

The Yunnan race is more heavily marked with black above than the majority of Leech's series of typical *jezabel* from Szechuan, but grades entirely into it (*yunnana*, subsp. n.).

Capt. Ward brought 4 ♂, 2 ♀ of this species from the Tsangpo. Of these one ♀ taken near Tramdo, 12,000 ft., Aug. 30, is *thibetana*; the other, from Tumbatse, 11,000 ft., Aug. 8, is inseparable from *jezabel*, but three rather worn ♂ ♂ taken with it Aug. 7–10 have a more fasciate appearance above and heavier black border than *jezabel*, and in size are transitional between it

and *thibetana.* The remaining ♂ from Rong Chu, 12,000 ft., July 13, is larger and quite like *jezabel.*

Vanessa urticæ chinensis.

♂ ♀. *Vanessa urticæ*, var. *chinensis*, Leech, Butt. China, i. p. 258, pl. xxv. fig. 1, ♀ (1899): Szechuan.

♀, taken at Penyangchang in the Loma Valley at 7900 ft., June 3.

Agrees with Leech's series of 4 ♂, 8 ♀.

Vanessa c-aureum.

Papilio c-aureum, Linné, Syst. Nat. (ed. 12) p. 778 (1767): [S.E.] China.

A worn ♂ of the summer (typical) form of this common Chinese species taken at Gadsze, 6600 ft., in the Yangtze Valley, June 21.

Araschnia davidis.

♂. *Araschnia davidis*, Poujade, Bull. Soc. Ent. Fr. 1885, p. xciv: Szechuan (Moupin).

♂. *Araschnia davidis*, var. *oreas*, Leech, Butt. China, i. p. 275, pl. xxvi. fig. 6 (1892): Szechuan (Putsufong, etc.).

♂, Yungning, 10,000 ft., June 3 (*Ward*). If there is anything in Leech's division, this is true *davidis*, more fulvous above, and less lilacine below.

Neopyrameis cardui.

Papilio cardui, Linné, Syst. Nat. (ed. 10) p. 475 (1758): Europe.

♂, Likiang, 8200 ft., June 18; ♀, Gadsze, 6600 ft., June 20.

♀, Yungning, 9500 ft., June 30 (*Ward*).

Precis almana.

Papilio almana, Linné, Syst. Nat. (ed. 10) i. p. 472 (1758): "Asia"; id. Mus. Ulr. p. 272 (1764): [S.E.] China.

A ♀ of the summer form (*asterie*, L.), taken at Chungtang in Salween Valley, at 7000 ft., May 27.

Asterie was described from India, and, if the Indian and Chinese forms are separable, is the oldest name for the former.

Precis orithyia.

Papilio orithyia, Linné, Syst. Nat. (ed. 10) p. 473 (1758): "Indies"; id. Mus. Ulr. p. 278 (1764): [S.E.] China.

Junonia orithyia, var. *leechi*, Alphéraky, Rom. Mem. ix. p. 103 (1897); = Leech, Butt. China, p. 280, pl. xxv. figs. 7, 9 (1894): Szechuan.

It is usually assumed that Linné's type was the Mus. Ulricæ specimen from China, a ♀ of the angulated or dry-season form with unicolorous hind wing beneath. The true type may possibly still be in existence and, if so, should be examined to see of what seasonal form it is.

Leechi was the name given to the summer (wet-season) form, less angular, and with ochreous ocellated underside.

Should typical *orithyia* be proved not to be Chinese, it must become the subspecific name.

Of Leech's eight Szechuan specimens all but one belong to it, and so do all this Yunnan series, but they are smaller, and the underside is much greyer, in colour like the d.s.f.

3 ♂, 5 ♀, Chuntang, 7000 ft., in the Salween Valley, May 24–29; ♀, Loma Valley, June 2; ♀, Mekong Valley, 7700 ft., June 26; ♀, Yangtze Valley near Chitien, Aug. 3.

Precis hierta hierta.

Papilio hierta, Fabricius, Ent. Syst., Suppl. p. 424 (1798): E. India.

♂, descent to Salween from Tengyueh, May 21; ♂ ♀, E. of Pupiao (on the way to Yungchang, 6000 ft., May 23.

There are evidently several races of this even in China, that from S.E. China and Hainan being larger and more tawny in both sexes, from Hupeh intermediate, and from Szechuan noticeably paler. The Yunnan specimens in this case, too, are smaller than Leech's.

Hypolimnas bolina bolina.

♂ w.s.f. *Papilio bolina*, Linné, Syst. Nat. (ed. 10) p. 479 (1758): India.

A worn ♂ of wet-season (summer) form taken on the Mekong near Yeichih, June 29.

Agrees with a pair taken by La Touche at Mengtze in S. Yunnan, and with Leech's ♂, 2 ♀, from Szechuan. These are true *bolina*, with a white-edged ♀ not differing from the Himalayan, and quite unlike the dark blue-flushed *kezia* from S. and E. China.

Neptis accris intermedia.

Neptis intermedia, Pryer, Cist. Ent. ii. p. 231, pl. iv. fig. 1, ♀ (1877) · Chekiang (Ningpo).

♂, Mekong River near Shawatsun, 6200 ft., June 29; ♂, Mekong Valley, N. of Yeichih, 6400 ft., July 1.

Intermediate in size between Leech's series from Szechuan and 2 ♂ from Mengtze taken by La Touche.

Neptis hylas eurynome.

♂ (nec ♀). *Papilio hylas*, Linné, Syst. Nat. (ed. 10) p. 486. n. 173 (1758): "Indies."

♂ w.s.f. *Limenitis eurynome*, Westwood, ed. Donovan's Ins. China, p. 66, pl. xxxv. fig. 4 (1842): [S.E. China].

♂ ♀ d.s.f. *Neptis sangaica*, Moore, Ann. & Mag. N. H. (4) xx. p. 47 (1877): Chekiang (Ningpo).

♂, Shimengtsing in the Loma Valley, 7000 ft., June 2; ♀, Yangtze Valley, near Shihku, 6400 ft., June 19.

Until it is settled where Linné's type came from, one must

retain *eurynome* for the Chinese race. Both specimens are of the d.s.f. (*sangaica*), smaller and less black-marked beneath. Leech's series from a wetter region are all *eurynome*.

Neptis mahendra extensa.

Neptis mahendra, var. *extensa*, Leech, Butt. China, i. p. 402, pl. xix. fig. 5, ♂ (1892): Szechuan.

♂. Pehyangchang, Loma Valley, 7000 to 8000 ft., June 4.
Considerably smaller and "drier" than Leech's series.

Neptis dejeani.

♂. *Neptis dejeani*, Oberthür, Et. Ent. xix. p. 15, pl. vii. fig. 61 (1894): Szechuan (Tatsienlu).

♂, Yangtze Valley, near Shihku, 6400 ft., June 19; ♂, Yangtze Valley, Gadsze, 7000 ft., June 22; ♂, Weihsi, 7700 ft., June 28; ♀, N. of Weihsi, June 26.

New to B.M. Oberthür had Yunnan (Tseku) specimens from Delavay. It is apparently distinct from *alwina*, with which it is placed by Stichel in Seitz, i. p. 175.

Neptis arachne giddeneme.

♂. *Neptis giddeneme*, Oberthür, Et. Ent. xv. p. 9, pl. i. fig. 7 (1891): Yunnan (Tseku).

♂, Yangtze Valley, Gadsze, 7000 ft., June 22.

New to B.M. As Stichel points out in Seitz (i. p. 180) it is a race of *arachne*, Leech; except for smaller size I see no difference between it and his Szechuan specimens, and these I cannot separate from the Hupeh types.

Neptis armandia.

Limenitis armandia, Oberthur, Et. Ent. ii. p. 23, pl. iv. figs. 4 *a*, 4 *b*, ♀ (1876): Szechuan (Moupin).

♂, Yangtze Valley, Gadsze, 7000 ft., June 22.

Decidedly smaller and "drier" than Leech's series of 4 ♂, 10 ♀ from Szechuan, though two of his ♀ ♀, taken at Washan in June, are "dry" with enlarged and paler markings (f. *lætifica*, Ob.); the rest, both in shape and markings, are difficult to distinguish from the ♂ ♂.

Neptis (*Rahinda*) *imitans.*

♂. *Neptis imitans*, Oberthür, Bull. Soc. Ent. Fr. 1897, p. 192, fig. 11: Yunnan (Tseku).

Hestina namoides, de Niceville, Journ. Bomb. N. H. Soc. xiii. p. 166, pl. DD. fig. 10, ♂ (1900): Yunnan (Tseku).

♀, Sekon, Jugeh River, 7300 ft., July 30; ♀, Tacheng, Chitsung River, 7300 ft., Aug. 1.

This very remarkable species, deceptively like *Hestina nama*, and with it and *Papilio* (*Cadugoides*) *agestor* mimicking the

Danaid *Caduga tytia*, has the sexes similar, and I place it in *Rahinda* in deference to the opinion of others, but have no idea what is to be considered its nearest ally. Oberthür considered it a rarity, "having in thirty years received less than twenty specimens." He figured it in Et. Lép. Comp. xii. (2) pl. 159. fig. 3507 (1916).

New to B.M.

Limenitis homeyeri venata.

♂ ♀. *Limenitis homeyeri*, var. *venata*, Leech, Butt. China, i. p. 183, pl. xvii. fig. 6, ♂ (1893): Szechuan.

2 ♂, Yangtze Valley, on road between Likiang and Weihsi, June.

Smaller and "drier" than any of Leech's 8 ♂ from Szechuan.

Limenitis cottini.

♂. *Limenitis cottini*, Oberthür, Et. Ent. ix. p. 17, pl. ii. fig. 5 (1884) Szechuan (Tatsienlu).

♂, Loma Valley, Tangweitang, 9630 ft., June 7.

This specimen has the white markings much more extended than in the 12 Szechuan ♂ ♂ in the B.M., including Leech's series and some of Biet's from the type-locality. Oberthür mentions Yunnan (Tseku) specimens taken by Dubernard, but as if they did not differ from the type, so that this specimen represents probably an extreme dry form (f. *albata*, nov.).

♂, Yungning, 10,000 ft., June 3; ♂, Shuiluchu, 9000 ft., June 24; 2 ♂, above Fengkow, Yangtze loop, 10,000 ft., July 8 (*Ward*).

Abrota ganga pratti.

♂ ♀. *Abrota pratti*, Leech, Entom. xxiv., Suppl. p. 28 (1891): Szechuan (Omeishan).

♀, Mekong Valley, near Nantao, 6400 ft., July 2.

Of the form *esvara*, Fruh., with light ochreous markings, not tawny as in the type.

Euthalia thibetana yunnana.

Euthalia thibetana yunnana, Oberthür, Bull. Soc. Ent. Fr. 1907, p. 260; id. Et. Lép. Comp. vi. pl. xcvii. fig. 948, ♂ (1912): Yunnan (Tseku).

♂, Mekong Valley, near Nantao, 6400 ft., July 3; ♂, Mekong Valley, Yangtsa, 6490 ft., July 11; ♀, Shuiluchu, 8000 ft., June 26; ♂, Yungning, 9500 ft., June 30 (*Ward*).

Euthalia duda sakota.

Euthalia duda sakota, Fruhstorfer, Seitz's Macrolep. ix. p. 684 (1913).
Euthalia duda (nec Staudinger), Oberthür, Bull. Soc. Ent. Fr. 1907, p. 260; id. Et. Lép. Comp. vi. pl. xcviii. fig. 949 (1912): Yunnan (Tseku).

♀, Tacheng, Chitsung River, 7300 ft., Aug. 1.

In this difficult *duda-thibetana* group one cannot be too positive of identification, but this specimen agrees well with Oberthür's figure, the ♂ type, except that the bands on both wings are white, as they are in typical *duda* from the E. Himalaya. As shown by Oberthür, the spots which form the band of fore wing are decidedly smaller than in the Himalayan race.

New to B.M.

Apatura ilia serarum.

♀. *Apatura ilia*, var. *serarum*, Oberthür, Et. Ent. xv. p. 11, pl. i. fig. 8, "♂" (1891) · Hupeh.

♂ ♀. *Apatura here*, var. *phædra*, Leech, Butt. China, i. p. 163, pl. xv. fig. 7, ♂ (1892): Szechuan.

♀, Yangtze Valley, between Likiang and Weihsi, June.

Agrees very nearly with Leech's ♀ type of *phædra* from Chiakouho, though the white markings are larger; both specimens are larger and broader-winged than those from C. China (Kiukiang) in the B.M. coll. The two forms are possibly separable as races, but I can see no difference in the ♂ ♂. Oberthür included Yunnan specimens in his *serarum*.

Apatura bieti.

♂ ♀. *Apatura iris*, var. *bieti*, Oberthür, Bull. Soc. Ent. Fr. 1885, p. 136; id. Et. Ent. xi. p. 18, pl. iii. fig. 15, ♂: Szechuan (Tatsienlu).

♂, Yangtze Valley, Beta, 7000 ft., June 22.

♂, Lapu (or Napu), 9000 to 10,000 ft., July 31 (*Ward*).

In Gregory's specimen the markings are paler, broader, and more sharply defined than in Leech's 6 ♂ from Szechuan (with which Ward's is identical), and agree with those of the single ♀ specimen from Tatsienlu figured by him (Butt. China, pl. xv. fig. 4), which, in spite of what Oberthür says in Et. Lép. Comp. iii. p. 180, I take to be the true ♀ of *bieti*. Apart from the colouring above, the species is distinguished from *iris* by the yellowish-tawny diffused ring round the eye-spot of fore wing beneath, and usually by the apical chocolate patch not reaching the termen.

Sephisa princeps.

♂. *Apatura princeps*, Fixsen, Rom. Lép. iii. p. 289, pl. xiii. figs. 7 *a*, *b* (1887): Corea; ♀. Leech, Entom. xxiii. p. 190 (1890): Corea.

2 ♂, from the Mekong Valley, one near Yeichih, 6400 ft., July 1, the other near Nantao at the same height next day.

Rather an unexpected capture, for there are no W. Chinese specimens in Leech's coll., though he records (Butt. China, i. p. 151) that a few had been taken at Omeishan, and the Stötzner expedition of 1914–16 obtained 2 ♂ from Wassukow. It seems to vary but little locally, and has perhaps spread N.E. and S.W. from C. China.

Fam. Satyridæ.

Lethe (*Blanaida*) *pulaha ramosa.*

♂. *Neope ramosa*, Leech, Entom. xxiii. p. 29 (1890): Hupeh (Changyang).

♂, Litang River, Muli, 7000 ft., May 19 (*Ward*). Of the dry-season form, in which the hind wing is dark purplish and has brown (not dark grey) spots following the row of eye-spots. Leech had a ♂ of this form from the type-locality and also a pair from Omeishan.

Col. Evans has recently (Journ. Bomb. N. H. Soc. xxix. (2) p. 536, 1923) detected that two allied species in the Eastern Himalaya have been confused under the name *pulaha*. His *pulahina* differs from the more common species in having a more rounded, less falcate, apex of fore wing; deeper yellow markings, which include a spot in 5 beyond the end of the cell, forming a third in the short bar from the costa, whereas in *pulaha* there are two only and the spot in 5, if present at all, is nearer the termen, directly over the large spot in 4. On the underside the pale markings are considerably extended, especially the bar from the costa at the end of the cell and the broad patch along the dorsum, but in the cell towards the base they are less distinct than in *pulaha*; the ground-colour of the hind wing is darker, and the markings more obscure.

Pulahina apparently ranges, as might be expected, into China. Leech had a ♂ from Kiatingfu (Szechuan), 1070 ft., and a ♀ from Changyang (Hupeh), 6000 ft., which agree very well together. They are of smaller size (60–62 mm.) than his *pulaha ramosa* of which the largest reach 70 mm., and differ from typical *pulahina* in having the spot in 5 as large as the two above it and the pale patches of the hind wing on which the eye-spots stand edged with brown externally. The ♂ has a very dry underside.

Lethe (*Blanaida*) *oberthueri.*

Neope oberthüri, Leech, Entom. xxiv., Suppl. p. 24 (1891): Szechuan (Omeishan).

2 ♂, Valley of Loma River (trib. Mekong), 7300–8000 ft., June 5. Smaller than Leech's series, and one is lighter beneath.

Lethe (*Blanaida*) *agrestis.*

♂ d.s.f. *Satyrus agrestis*, Oberthür, Et. Ent. ii. p. 29, pl. ii. figs. 3 *a*, *b* (1876): Szechuan (Moupin).

♂ ♀ w.s.f. *Neope agrestis*, var. *albicans*, Leech, Butt. China, i. p. 54, pl. vii. fig. 7 (1892): Szechuan (Tatsienlu).

♂, Yangtze Valley, between Likiang and Weihsi, June 19 to 21.
♂, Litang River, Muli, 10,000 ft., June 3 (*Ward*).
Both are d.s.f., smaller than Leech's specimens, and agree with a ♂ taken by Bailey at Ridong near Menkong in S.E. Thibet, 12,000 ft., June 17, 1911.

Lethe (*Blanaida*) *simulans.*

♂ ♀. *Neope simulans*, Leech, Entom. xxiv., Suppl. p. 66 (1891); Butt. China, i. pl. viii. fig. 2 (1892): Szechuan.

♂, on divide between Feilung and Yunlung, 8000–9000 ft., May 30. Smaller than, but otherwise similar to, Leech's Szechuan series.

Lethe (*Magula*) *jalaurida.*

Lethe jalaurida plistia, Fruhstorfer, Seitz's Macrolep. ix. p. 394, = *gelduba*, id. ibid. p. 313, nec p. 312 (1911): W. China.

♂, near Longsha, 7200 ft., July 31.

Leech's specimens from Szechuan differ only very slightly from typical *jalaurida* from N.W. Himalaya, mainly in the less development of the violet-white marks near tornus of hind wing, and I doubt if a new name is justifiable.

Lethe (*Magula*) *helle.*

Zophoessa helle, Leech, Ent. xxiv., Suppl. p. 1 (1891): Szechuan (Washan).

♂ ♀, Yangtze Valley, E. of Janula, 14,000 ft., July 24.

Both specimens are worn, but differ decidedly from *helle*, not only (as usual) in smaller size but in the paler ground-colour of the hind wing beneath, and the absence therefrom of the series of violet crescents which bound the dark bands, these being replaced by whitish and much more regular lines (*gregoryi*, subsp. n.). It is true that Leech's series varies to some extent in this particular, and consequently I think this probably only a race of *helle*, taken as they were 4000 ft. higher than any of his.

Lethe (*Magula*) *gracilis.*

Pararge gracilis, Oberthür, Ét. Ent. xi. p. 23, pl. iv. fig. 19 (1886): Szechuan (Tatsienlu).

♂, Yangtze loop, 9000–10,000 ft., July (*Ward*). Not differing from 18 ♂ from Szechuan in B.M.

Lethe (*Sinchula*) *maitrya.*

♂. *Lethe maitrya*, de Nicéville, Journ. As. Soc. Beng. 1880, p. 245: N.W. Himalaya.

2 ♂, Atuntze, 12,000 ft., July 20; ♂, Sekon, Jugeh River, 7300 ft., July 30. A Himalayan forest-species, as far as I know not previously taken further east than Bhutan.

Lethe (*Lethe*) *confusa apara.*

Lethe rohria apara, Fruhstorfer, Seitz's Macrolep. ix. p. 315 (1911): Tenasserim, etc.

♂, Weihsi River, June 28.

Lethe (*Pegada*) *oculatissima.*

♂. *Mycalesis oculatissima*, Poujade, Bull. Soc. Ent. Fr. 1885, p. xxiv Szechuan (Moupin).

♂, Yangtze Valley, Beta, 7000 ft., June 22.

Lethe (*Tansima*) *marginalis.*

Satyrus marginalis, Motschulsky, Et. Ent. ix. p. 29 (1869): Japan.

2 ♂, Mekong Valley, N. of Yeichih, 6400 ft., July 1.
A little smaller than Leech's.

Pararge (*Tatinga*) *thibetana.*

Satyrus thibetanus, Oberthür, Et. Ent. ii. p. 28, pl. ii. fig. 4, ♂ (1876): Szechuan (Moupin).

♂, Yangtze Valley, between Likiang and Weihsi, May; ♂, Yangtze Valley, S. of Hoching, 10,000 ft., Aug. 11; ♂, no data.
♂, Yangtze loop, 9000 to 10,000 ft., July 10 (*Ward*).

Mycalesis (*Samanta*) *misenus sericus.*

♂ ♀. *Mycalesis misenus*, var. *sericus*, Leech, Butt. China, i. p. 15, pl. ii. fig. 10, ♂ (1892): Szechuan (Omeishan).

♂, Mekong Valley, Weishi road, 7000 ft., June 28.
Rather larger and more distinctly marked than Leech's series, and in the prominence of the apical spot of fore wing and the pale terminal lines of hind wing intermediate between it and *misenus* from Assam.

Mycalesis (*Gareris*) *francisca.*

♀ d.s.f. *Papilio francisca*, Cramer, Pap. Exot. iv. p. 75, plate cccxxvi. figs. E, F (1780): [S.E.] China.

2 ♂, d.s.f., valley of Loma (trib. Mekong), 7000–8000 ft., June 4.
With a smaller eye-spot and a broader, more uniform grey margin of hind wing beneath than Leech's Szechuan and Hupeh specimens, which he called *perdiccas* (from the Japanese race).

Palæonympha opalina.

♂ ♀. *Palæonympha opalina*, Butler, Trans. Ent. Soc. Lond. 1871, p. 401: Shanghai.

♂, Loma Valley (trib. Mekong), 7000–8000 ft., June 4.
Leech's 5 ♂ from Changyang in Hupeh (he had no Szechuan specimens except a ♀ from Moupin) all agree in having very much reduced brands, the eye-spot of fore wing is smaller and the transverse lines of the underside narrower and less yellow, and this form is probably racial in W. China, as, though this Yunnan specimen is worn, I can see no trace of the brands.
Besides Butler's type from Shanghai, there are three other ♂ ♂

in the B.M. coll. from Chekiang province, and Leech had 7 ♂, 1 ♀, from Kiukiang in Kiangsi; all these agree in having broad androconia in the ♂ along vein 1, the lower side of the cell, and the bases of veins 2 and 3.

I propose for the new form the name *reducta*, subsp. n., taking as types the five pairs from Changyang.

Ypthima insolita.

♂. *Ypthima insolita*, Leech, Ent. xxiv., Suppl. p. 66 (1891): Szechuan.

2 ♀, Loma Valley (trib. Mekong), 7000–8000 ft., June 4. Leech's 3 ♂ came from Wassukow.

The ♀ does not differ at all, except (as usual) in paler colouring.

Ypthima sakra.

Ypthima sakra, Moore, Cat Lep. E. I. C. Mus. i. p. 236 (1857): Sikkim.

♂, Salween Valley, between Chuentang, 7000 ft., May 27. A little smaller than Leech's long series from Szechuan.

Ypthima nareda phania.

Epinephele phania, Oberthür, Et. Ent. xv. p. 17, pl. ii. fig. 17 (1891) Yunnan.

♂, Yangtze Valley, Beta, 7000 ft., May; ♀, Jugeh River, 8500 ft., July 28; ♀, Yangtze Valley, Beta, 7300 ft., July 30. All three worn.

♂, Yungning, 9500 ft., June 30 (*Ward*).

Considerably smaller than the Szechuan race *chinensis*, Leech, and nearer to the Assam *newara*, but the more northern (Yungning) specimen is transitional to it, and is to me indistinguishable from the unique type of *sordida*, Elwes & Edwards, from Kiukiang. I take this to be merely the dull form with undeveloped marginal lines, such as can be found in *sakra nikæa* and other Ypthimas.

Ypthima avanta.

Ypthima avanta, Moore, Proc. Zool. Soc. Lond. 1874, p. 567: Kashmir.

♂, Luchang, 4500 ft., May 28; 2 ♂, 1 ♀, Luchang to Feilung, 4500 ft., May 29.

Ypthima baldus.

Papilio baldus, Fabricius, Syst. Ent. app. p. 829 (1776): India.

♀, Salween, May 21; ♀, Salween, near Lantienpa, 6000 ft., May 26. They agree with a ♂ taken by La Touche at Mengtze.

Ypthima ciris.

Ypthima ciris, Leech, Ent. xxiv., Suppl. p. 4 (Jan. 1891): Szechuan.
Ypthima clinia, Oberthur, Et. Ent. xv. p. 16, pl. ii. fig. 13 (June 1891): Szechuan (Tatsienlu).

♂, Mekong Valley, near Shanatsan, 6200 ft., June 29; Mekong Valley, N. of Yeichih, 6400 ft., July 1; ♂, Mekong Valley, near Yangtsa, July 11.

Differ from Leech's series not at all in size, but have a bar of paler ground-colour preceding the eye-spots of hind wing.

Ypthima yunnanana.

♂. *Aphantopus yunnananus*, Swinhoe, Ann. & Mag. Nat. Hist. (8) xvi. p. 172 (Sept. 1915): Yunnan.

A ♂, Loma River (trib. Mekong), 7000–8000 ft., June 4, agrees exactly with Swinhoe's type. Markings of hind wing underside as *ciris*, but without the striations, and the whole insect is duller.

Ypthima sp.

7 ♂, 3 ♀, the ♂ ♂ in the Loma Valley June 2–5, the ♀ ♀ in the Yangtze and Mekong Valleys June 19–28, all at elevations of 5700 to 7400 ft. Also a pair of more d.s.f. taken in May and without more than traces of eye-spot on hind wing beneath.

Nearest in markings of underside to *iris*, Leech (*dromonides*, Ob.), but smaller, darker, and with less oblique apical eye-spot. Awaits study of the Oberthür coll.

Ypthima burmana.

Ypthima asterope burmana, Evans, Journ. Bomb. N. H. Soc. xxix. (3) p. 786 (Dec. 1923): N. Burma (Maymyo).

♂, in narrow gorge five miles N. of Yunlung, 5700 ft., June 1; ♂, valley of Loma River (trib. Mekong), 5700–7400 ft., June 2.

The genitalia of this little species, which have been examined by Capt. Riley, are quite different from those of *asterope*, the distal half of the clasper being narrow pointed and straight, whereas in *asterope* it is curved and widened at the tip.

We associate with these and Evans's types (taken in June and July) a d.s.f. from the S. Shan States, taken Jan. 1891, and 2 ♂ taken near Hongkong, June 21, 1921.

Callerebia suroia.

♂ ♀. *Callerebia suroia*, Tytler, Journ. Bomb. N. H. Soc. xxiii. (2) p. 218, (3) pl. i. fig. 2 (1914–1915): E. Assam (Manipur Hills).

♂, Yangtze Valley, Gadsze, 6600 ft., June 21; ♀, Mekong Valley, N. of Yeichih, 6400 ft., July 1. The ♂ has a well-marked rust-coloured black-centred spot on the underside of hind wing in 2; the ♀, which is a dwarf, has none whatever; but our only other Yunnan ♀, one of Dubernard's from Tseku, has small spots in both 1 *c* and 2.

The arrival of the Oberthür collection, containing the type of

polyphemus described and figured by him in Et. Ent. ii. p. 33, pl. ii. fig. 2 (1876), shows that I was mistaken in identifying it with *suroia* (Ann. & Mag. Nat. Hist. (9) xvi. p. 234). My *oberthueri* will be the normal *polyphemus*, in which hind wings have two spots beneath (the type having none), and the highly ocellated form figured by Leech and Seitz, with four spots in fore wing above and beneath, I name *perocellata*, f. nov.

Loxerebia sylvicola.

Callerebia sylvicola, Oberthur, Et. Ent. xi. p. 24, pl. iv. fig. 25 (1886): Szechuan (Chapa = Lutinkiao).

10 ♂, Loma Valley, 5700–7400 ft., June 2–5; 4 ♂, N. of Tali, 7700–10,000 ft., June 8–9; ♂ ♀, Yangtze Valley, near Shihku, 6400 ft., June 19; ♂, Yangtze Valley, near Tangchulin, 11,000 ft., July 25; ♂, without data; ♂, Yungning, 9500 ft., June 30 (*Ward*).

All the Yunnan ♂ ♂ have considerably less development of the eye-spots than Leech's ♂ ♀ from Szechuan and a paratype received from Oberthür, the most northerly (Yungning) being transitional. The ♀ differs in the same way and has a pale, almost grey, area round the apical eye-spot above (*gregoryi*, subsp. n.).

The high-elevation (Tangchulin) ♂ has a different underside, the apical spot of fore wing being considerably larger and bordered internally by a white curved bar, the hind wing with ground-colour whiter and the row of spots smaller.

Hemadara ruricola.

♂. *Erebia ruricola*, Leech, Ent. xxiii. p. 187 (1890): Szechuan (Tatsienlu).
♂. *Callerebia delavayi*, Oberthur, Et. Ent. xv. p. 13, pl. ii. fig. 18 (1891): Yunnan.

♂, Valley of Loma River, Tangweitang, 9630 ft., June 7.

This is an undoubted *ruricola*, of which Leech has 7 ♂, and not the form which Oberthür named *delavayi* and Leech thought a slightly differing race. This latter has a more rounded apex of fore wing, paler terminal area, heavier brands, a larger eye-spot, and a paler underside, without any trace of russet-brown striation at apex of fore wing. It should, I think, for the present be considered a good species.

Agapetes meridionalis.

Melanargia halimede, var. *meridionalis*, Felder, Wien. Ent. Monat. vi. p. 29 (1862): Chekiang (Ningpo).

♂, Jugeh River, 7000–9500 ft., July 28.

Thinly marked, but not separable from Leech's very variable series of 18 ♂, 7 ♀, from Szechuan. Has been taken also on the Indian side of the Burma–Yunnan frontier.

These W. Chinese forms are far from being typical *meridionalis*, being nearer to, though not so dark as, *epimede*, Stgr., from Amurland.

Hipparchia hyperanthus bieti.

♂ ♀. *Epinephele bieti*, Oberthür, Et. Ent. ix. p. 17, pl. ii. fig. 2, ♂ (1884): Szechuan (Tatsienlu).

♂, near Gadya, 6600 ft., Aug. 4; ♂, S. of Hoching, 10,000 ft., Aug. 11.

Smaller than Leech's series, with no spots on the fore wing, above or beneath.

Satyrus palæarcticus iole.

Œneis pumilus, var. *iole*, Leech, Butt. China, i. p. 75, pl. xi. fig. 2, ♂ (1892): Szechuan (Howkow).

♂, Litang River, 10 miles S.W. of Muli, 12,000 ft., July 30 (*Ward*).

Satyrus sybillina.

Satyrus sybillina, Oberthur, Et. Ent. xiii. p. 40, pl. x. fig. 106, ♀ (1890): Szechuan (Tatsienlu).

♂, Yangtze Valley, between Likiang and Weihsi, May; ♂, Mekong-Yangtze divide, E. of Atuntze, above 12,000 ft., July 17.

Fam. **Riodinidæ** (Erycinidæ).

Dodona durga sinica.

♂. *Dodona sinica*, Moore, Lep. Ind. v, p. 73 (1901): Szechuan.
♂ ♀. *Dodona durga*, var., Leech, Butt. China, p. 291, pl. xxviii. fig. 1, ♂ (1893): Szechuan.

♂, Loma Valley, Chientsau, 7400 ft., June 2; ♂, Mekong Valley, N. of Weihsi, 6000–7000 ft., June 27, worn. A little smaller than, but otherwise similar to, Leech's series; not Fruhstorfer's *rubula*.

Fam. **Lycænidæ.**

Lycæna pheretes major.

♂ ♀. *Lycæna pheretes major*, Evans, Journ. Bomb. Nat. Hist. Soc. xxiii. (3) pp. 544, 545 (1915): S.E. Thibet.

3 ♂, Mekong Valley, near Atuntze, 12,000 ft., July 21; 2 ♂, Mekong Valley, Peimashan, 14,000 ft., July 23; ♂, Kari, 9000 ft., July 27; ♂, without loc. The last is as large as the type of *major*, which was taken at 9500 ft.; 2 ♂, 2 ♀, taken by Ward at Tumbatze, on the Tsangpo, at 11,000–12000 ft., August 4–10, 1924, do not differ appreciably, nor does Leech's Szechuan series, but Fawcett's race *pharis* from Khambajong is much smaller and darker, and a long series from Gyangtze is intermediate. Like most high species it is very variable.

Lycænopsis dilectus.

♂ ♀. *Polyommatus dilectus*, Moore, Proc. Zool. Soc. Lond. 1879, p. 139: Nepal.

♂, Salween Valley below Chuentang, 7000 ft., May 27; ♂, Mekong Valley, near Weihsi, June 28; ♂, without loc. Agree with Leech's 3 ♂ from Szechuan.

Lycænopsis argiolus jynteana.

♂ ♀. *Cyaniris jynteana*, de Nicéville, Journ. As. Soc. Bengal, lii. (1) p. 69. n. 5, pl. i. fig. 7 ♂, 7*a* ♀ (summer 1883): Sikkim.
♂. *Cyaniris sikkima*, Moore, Proc. Zool. Soc. Lond. 1883, p. 524, pl. xlviii. fig. 11.

4 ♂, Mekong Valley, Weihsi Road, June 29. [♂, Tsangpo Valley, Tsela Dzong, 10,000 ft., May 11, 1924 (*Ward*).]

The ♂ has a much broader black border at apex and termen of fore wing than typical *argiolus*, which Leech's Szechuan series resembles much more closely.

Limbata, to which the specimens submitted to Chapman for dissection as *jynteana* belonged, can be separated from this broad-bordered form of *argiolus* by the presence (usually) of an additional spot in 1 of fore wings beneath at the bottom of the discal row, by the greater obliquity of the spot in 4, and in hind wing by having a distinct black spot on the costa at two-thirds, and the central spots of the postmedian row forming a less regular curve.

Lycænopsis huegelii oreas.

♂ ♀. *Cyaniris oreas*, Leech, Butt. China, ii. p. 321, pl. xxxi. figs. 12 ♂, 15 ♀ (1893): Szechuan.

♂, Yangtze Valley, Beta, 7000 ft., June 22; 3 ♂, Mekong Valley, Weihsi, 7700 ft., June 26; ♀, Sekon, 7300 ft., July 30; ♂ ♀, Tacheng, 7300 ft., Aug. 1; 5 ♂, Yangtze Valley, S. of Hoching, 10,000 ft., Aug. 11; ♂, Yangtze Valley, N. of Ninkai, 7300 ft., Aug. 12; ♂, Tali Plain, 4700 ft., March 14, 1921 (*Ward*). These Yunnan specimens appear to be transitional to Evans's *oreoides* from S.E. Thibet.

Lycænopsis morsheadi.

♂ ♀. *Cyaniris morsheadi*, Evans, Journ. Bomb. N. H. Soc. xxiii. (3) p. 543 (1915): S.E. Thibet (Tsangpo).

♂, Atuntze, 12,000 ft., July 20; 8 ♂, Yangtze Valley, E. of Janula, 14,000 ft., July 24; ♂, Yangtze Valley, Tongchuling, 11,000 ft., July 25; ♂, Kari, 9800 ft., July 27; 2 ♂, Jugeh River, 8500 ft., July 28; ♂, Sekon, 7300 ft., July 30.

A distinct species, rather deeper blue than *huegelii* and with a broad and regular deep black border on both wings. The types were taken by Bailey at Tsela on the Tsangpo, 10,000 ft., Aug. 9, 1913, and have a brownish-white underside similar to typical

huegelii, also a faint metallic-green suffusion at the base of hind wing beneath. All Gregory's specimens, with the exception of that from Tongchuling, have a greyish-white underside deceptively like that of *oreas*, but rather more strongly black-marked, and have *no* green suffusion. They form, at any rate, a well-marked race (*gregoryi*, subsp. n.). In those from the lower elevations more or less of the blue ground-colour shows in the black border of hind wing.

The Tongchuling specimen has an underside with ground-colour as in typical *morsheadi*, but differs from it and all the rest in having a complete angled row of postmedian spots on the fore wing beneath in all the interspaces 1–6, those from 3–6 being in an absolutely straight line. None of the others have a spot in 1, and that in 6 is always far behind the line of 3–5. It has also the border of the hind wing above very much reduced. For the present it must be considered an aberration.

Chilades yunnanensis, sp. n.

♂, Yungchang, 5500 ft., May 24.

Resembles a small *Euchrysops pandava*. Blackish brown with faint bronze-green reflection; fore wing on basal and dorsal areas, hind wing except on border, powdered with metallic light blue scales; fore wing with small black discal spot faintly surrounded with pale, hind wing with three equal black marginal spots in areas 1–3 bordered with pale externally but without any orange; there is no trace of a tail at end of vein 2. Underside similar to that of wet-season *pandava*, but the spots of the postmedian row of fore wing are definitely black, and those of 3–6 are on less of a curve; on the hind wing, in place of the large orange-ringed marginal spot in 2 and smaller one in 1 *b*, there is a row of three equal ones as above, divided and preceded by light orange, and each bearing in its posterior half a few shining metallic light blue scales.

The specimen is much damaged, and had not both Mr. G. T. Bethune-Baker and Capt. Riley assured me that it was new to them, I should not have described it.

Everes ion.

♂ ♀. *Lycæna ion*, Leech, Entom. xxiv., Suppl. p. 58 (1891); Butt. China, p. 331, pl. xxxi. fig. 4, ♂ (1893): Szechuan (Tatsienlu).

♂, Loma Valley, Chientsou, 6000–7400 ft., June 2; ♂, Mekong Valley, N. of Weihsi, 6000–7400 ft., June 27; ♀, N. of Chitien, 7500 ft., Aug. 2.

Similar to Leech's Szechuan series.

Zizera maha.

Lycæna maha, Kollar, von Hugel's Kaschmir, iv. (2) p. 422 (1848): W. Himalaya.

♂, Salween Valley, May 21; Salween Valley, Chuntang, 7000 ft., May 27; ♂, Luchang, 4500 ft., May 28; ♀, Yangtze Valley,

Gadsze, 6600 ft., June 21; ♀, Mekong Valley, N. of Weihsi, 6000–7700 ft., June 27; ♂, Mekong Valley, near Shuwatsun, 6200 ft., June 29; ♀ (much worn), Jugeh River, 8500 ft., July 28; ♂, Yangtze Valley, near Chitien, 7000–8000 ft., Aug. 3; ♀ (fresh), without locality.

Lampides bœticus.

Papilio bœticus, Linné, Syst. Nat. (ed. 12) i. p. 789 (1767): Barbary.

2 ♂, E. of Pupiao, 4400 ft., May 23; ♂, Luchang to Feilung, 4500 ft., May 29.

Heodes pang.

Chrysophanus pang, Oberthür, Bull. Soc. Ent. Fr. 1886, p. xii; Et. Ent. xi. p. 19, pl. v. fig. 36, ♂ (1886): Tatsienlu.

♀, without locality. [♂ ♀, Tsangpo Valley, Lusha, 13,000 ft., May 19, 1924 (*Ward*).]

Ward's ♀ agrees with the Szechuan series, except that the tawny ground-colour extends to form a spot in the cell of fore wing; Gregory's, in addition, has the white band of the underside of hind wing nearly straight instead of elbowed. In this species the black spots of the underside are ringed with purplish blue.

Heodes li.

Chrysophanus li, Oberthür, Bull. Soc. Ent. Fr. 1886, p. xxii; Et. Ent. xi. p. 19, pl. v. figs. 34 ♂, 38 ♀ (1886): Tatsienlu.

♂, Yangtze Valley, 7000 ft., July 25; ♀, Litang River, Muli, 9000 ft., May 31, 1922 (*Ward*).

Unlike all the Szechuan series, the ♀ has no purple markings above except obscurely in centre of hind wing and at tornus.

Spindasis syama latipicta.

Aphnæus syama latipicta, Fruhstorfer, Berl. Ent. Zeit. lvi. p. 217 (1912): Tonkin.

♀, Luchang to Feilung, 4500 ft., May 29. A worn example which agrees with Upper Burma specimens much better than with the large *sepulveda*, Fruh., from Szechuan and Hupeh.

Heliophorus androcles.

♂. *Ilerda androcles*, Doubleday and Hewitson, Gen. Diurn. Lep. ii. p. 487, pl. lxxv. fig. 2 (1852): Assam (Silhet).

♂, Salween, May 21. A d.s.f., again more like the Upper Burma than the Szechuan form.

Strymon œnone.

♂ ♀. *Thecla œnone*, Leech, Butt. China, p. 366, pl. xxix. figs. 6 ♂, 9 ♀ (1893): Szechuan (Mts. N. of Tatsienlu).

♂, Yangtze Valley, Tongchuling, 11,000 ft., July 25.

Differs from Leech's type in the continuation of the white band

of fore wing beneath nearly to tornus, its greater distinctness on the hind wing, and the less orange round the tornal spots—in these points agreeing with a specimen taken by Potanine in the mountains near Batang, S.E. Thibet, in June 1893.

Apparently a rare species found at high elevations.

Thecla mandara bieti.

♂ ♀. *Thecla bieti*, Oberthür, Et. Ent. xi. p. 19, pl. iv. fig. 22, ♂ (1886): Tatsienlu.

♂, Yangtze loop, 9000-10,000 ft., July 10 (*Ward*).

♂, Mekong Valley, S. of Atuntze, July 11; ♂, Yangtze Valley, E. of Janula, 14,000 ft., July 24.

[2 ♂, Tsangpo Valley, Tumbatze, 11,000 ft., Aug. 7, 8; ♂, Tsangpo Valley, Pasum Lake, 11,000 ft., Aug. 17, 1924 (*Ward*).]

Two of the Yunnan specimens agree well with Leech's Szechuan series, the one taken by Ward has the thickening of the cell-spot and postmedian bar beneath, which is characteristic of the rare *dohertyi*, Niceville, from the W. Himalaya, and in a still more marked degree, of *irma*, Evans, of which the type is a ♂ taken by Bailey at Pernitanka, Bhutan, 9000 ft., July 6, 1922. The Tsangpo specimens have the regularly curved bands beneath of typical *bieti*, but what external edging there is to them is white as in *dohertyi*, not yellow, and there is a trace of the bluish-metallic markings at tornus of hind wing found in *irma*.

I believe *mandara*, Doherty (described from Kumaon), to be the oldest name for the collective species.

Fam. Pieridæ.

Aporia martineti.

♂. *Pieris martineti*, Oberthür, Et. Ent. ix. p. 12, pl. i. fig. 5 (1884): Szechuan (Tatsienlu). ♀. Ibid. xiii. p. 38, pl. ix. fig. 98 (1890): Yunnan.

♂, Yangtze Valley, between Likiang and Weihsi, May–June (*Lewer*). Does not differ from Szechuan specimens.

Aporia hippia bieti.

♂ ♀. *Pieris bieti*, Oberthür, *loc. cit.* p. 12, pl. i. figs. 7, 8 (1884): Szechuan (Tatsienlu).

48 ♂, 8 ♀, from various localities and elevations of 8000–12,000 ft., differing little among themselves except in size, but sharply divided from typical *bieti* from Szechuan by the less heavily black-marked veins in both sexes, and in the ♀ by the shorter, more rounded wings which have much less of a hyaline appearance and nearly resemble the ♂, but have the hind wing faintly yellow-tinted (*gregoryi*, subsp. n.). Types ♂ ♀ from N. of Tali, W. of Yangtsien, 8000 to 10,000 ft., June 8.

Two ♂ specimens taken by Ward on the Litang River, near

Muli, are intermediate, having enlarged veins and more black sprinkling.

We have also a ♂ of *transiens*, Alph., taken by Bailey in S.E. Thibet, which comes near to the Atuntze (or alpine) ♂ ♂, but is deeper yellow beneath.

4 ♂, taken by Ward in the Tsangpo Valley at Pé, 9000 ft., June 10, 1924, are practically *gregoryi*.

Aporia nabellica lhamo.

♂. *Pieris lhamo*, Oberthür, Et. Ent. xviii. p. 13, pl. ii. fig. 27 (1893) Yunnan (Tseku).

♀, Mekong Valley, S.E. of Atuntze, 12,000 ft., July 20. Fore wing shaded with black as in ♂, but differs in having distinct whitish streaks in the interspaces at the end of the cell, and a row of more distinct whitish subterminal blotches (except in interspace 4); the hind wings have no black central shading, but only the black veins and arrow-heads; underside as ♂.

Aporia potanini.

♀. *Aporia potanini*, Alphéraky, Rom. Mém. v. pp. 95–96, pl. v. fig. 1 (1889), vi. pp. 1, 2 (1892): Kansu (Heiho Valley). ♂. Id. ibid. ix. p. 89 (1897): Szechuan (Lunanfu = Khotsigu).

6 ♂, Valley of Loma River, 7300–9000 ft., June 5 and 6; 3 ♂, Yangtze Valley, Gadsze to Beta, June 22; 1 ♂, without locality.

Genestieri, Ob., from Lutsekiang on the Salween, may possibly be conspecific, but differs much in appearance as stated by Verity.

Aporia goutellei.

♂. *Pieris goutellei*, Oberthür, Et. Ent. xi. p. 15, pl. ii. fig. 11 (1886): Yunnan (Tseku).

♂, Yungning, 10,000 ft., June 3, 1921 (*Ward*); ♂, Litang River, Muli, 7000 ft., May 19 (*Ward*).

These differ much, the Yungning specimen having a completely white hind wing, except for the basal shading and the blackened extremities to the veins, and agreeing with Verity's figure of his *tsinglingica* (Rhop. Pal. pl. lix. figs. 6, 7) from Kansu, which may be racial, but perhaps more probably a form which occurs with the type.

The Muli specimen is much duskier, all the veins are black, and the black arrow-heads of the underside are also marked, and it agrees well with Oberthür's figure of the type and with a ♂ from the Elwes collection from Atuntze.

Of Leech's Szechuan series of 10 ♂, 1 ♀, several are darker than the Yunnan ♂ ♂, and agree with Verity's figure of his form *melanochroa*.

Aporia hastata.

♂ ♀. *Pieris hastata*, Oberthür, Et. Ent. xvi. p. 5, pl. i. fig. 6, ♂ (1892): Yunnan.

♂ ♀, N. of Tali, W. of Yangtsien, 8000–10,000 ft., June 8. New to B.M.

Aporia larraldei nutans.

♂ ♀. *Pieris larraldei*, Oberthür, Et. Ent. ii. p. 19, pl. i. fig. 2 *a*, 2 *b* ♂ (1876): Szechuan (Moupin).
Pieris larraldei, f. *melania*, Oberthür, ibid. xv. p. 5, pl. i. fig. 5 (1892): Szechuan (Tatsienlu).
Pieris larraldei, f. *nutans*, Oberthür, ibid. xv. p. 6, pl. i. fig. 3 (1892): Yunnan (Tapintze).

♂, Yangtze Valley, Gadsze to Beta, 7000 ft., June 22. New to B.M.

Oberthür considered all three forms to be local races, and probably this Yunnan form, with orange instead of yellow basal spot beneath, and other differences in the spots of hind wing, is a good race, but whether the form *melania*, with white markings reduced, can be separated racially from *larraldei* in which they are prominent, seems doubtful; Leech's 5 ♂ from Tatsienlu are all *melania*, but so too is one of his from Moupin.

An allied but quite distinct species in this *hastata* group is *harrietæ*, de Nicéville, from Bhutan, with races *baileyi*, South, in S.E. Thibet, and *paracræa*, de N. (syn. *albivena*, Ob.), in W. China. This has white spots on and not before the termen of both wings, has the cells of both wings entirely edged with white, a complete series of white postmedian spots in fore wing, including one in 3 which is absent in *larraldei*, and on the underside of hind wing the points of the black arrow-heads reach the termen.

Acræa, Ob. (syn. *lotis*, Leech), is a third species of the same group, distinguished at a glance from either of the other two by the very narrow black margins of the veins and arrow-heads of the hind wing beneath. Oberthür described it from an ab. (*hunkei*, Draeseke) with complete white band on fore wing above.

Aporia delavayi.

Pieris delavayi, Oberthür, Et. Ent. xiii. p. 37, pl. ix. fig. 97, ♀ (1890): Yunnan.

♂, Yangtze Valley, Gadsze, 6600 ft., June 21; ♂, Mekong–Yangtze divide, E. of Atuntze, above 12,000 ft., July 14–17; 3 ♂, Yangtze Valley, E. of Janula, 14,000 ft.; July 24; ♂, Yangtze Valley, near Pongtsuling, 9000 ft., July 25; ♀, Sekon, Jugeh River, 7500 ft., July 30.

A little smaller than the Szechuan series.

Aporia agathon.

♂. *Pieris agathon*, Gray, Zool. Misc. p. 33 (1831): Nepal.

39 ♂, 5 ♀, taken in June in very various localities at about 7000–9000 ft.

Having the cell of fore wing and the long stripes below it and cell of hind wing more broadly pale than in Assamese specimens. Like these they agree better with *ariaca*, M., from Kumaon than with the typical black-sprinkled *agathon* from Sikkim and Nepal.

Not previously in B.M. from China.

Pieris davidis.

♂. *Pieris davidis*, Oberthür, Et. Ent. ii. p. 18, pl. i. fig. 5 (1876): Szechuan (Moupin).

♂. Yungning, 10,000 ft., June 3, 1921 (*Ward*).

Agrees with Leech's series.

Pieris davidina.

Spring form. ♂. *Pieris davidina*, Oberthür, Et. Ent. xv. p. 8, pl. iii. fig. 20 (1891): Szechuan (Moupin).

Summer form.
♀. *Pieris davidis* (ex err.), Leech, Ent. xxiv., Suppl. p. 57 (June 1891); id. Butt. China, ii. p. 468, pl. xxxvi. fig. 1 (1894): Tatsienlu.
♀. *Pieris davidis*, f. *nigricans*, Verity, Rhop. Pal. p. 137, pl. xxix. fig. 16 (1907): Tatsienlu.
♂. *Pieris davidis*, id. ibid. pl. xxx. fig. 46: Szechuan (Lutsekiang).
♂. *Synchloe stoetzneri*, Draeseke, Iris, xxxviii. p. 6 (1924): Tatsienlu.

5 ♂, Yungning, 10,000 ft., June 3, 1921 (*Ward*); ♀, Kari, 9800 ft., July 22 (*Gregory*).

Oberthür described the species from a spring form with heavily veined underside answering to the form *venata*, Leech, of *davidis*. Leech had a summer form ♂ labelled as taken by native collectors at Chowpinsa, Szechuan, 5000 ft., May–June 1890, and also the ♀ of it (which he figured as the then unknown ♀ of *davidis*, and Verity, who knew *davidis* ♀, as his form *nigricans*). This ♀ was taken at Tatsienlu at 8300 ft. by Pratt among ♂ ♂ of *davidis*, May–June 1890.

There are also in the B.M. 14 ♂ ♂ from Tseku, taken by Dubernard, including 6 of the typical (spring) form with deeply veined underside, and 2 ♂ from Lutzekiang, taken by Genestier.

All of these came from the Oberthür coll.

In addition to the characters mentioned by Draeseke for his *stoetzneri*, I find that, on the underside of the hind wing in addition to the black streak within the cell which in *davidis* forms a complete junction with vein 5, in *nigricans* there is a fork or branch out of it on the lower side, and often more strongly marked than itself, which ends on the lower discocellular vein at about its

middle. The ♀ only differs from the ♂ in having the fore wing wholly suffused with black except for white spots beyond the end of the cell in 4, 5, and 8, and a fainter terminal row of 7 spots.

Pieris brassicæ nepalensis.

♂ ♀. *Pieris brassicæ*, var. *nepalensis*, Gray, Lep. Ins. Nep. pl. vi. figs. 1 ♂, 3 ♀ (1846): Nepal.

7 ♂, Yungchang, 5500 ft., May 24; ♂, Loma River, Lanchow, 8000-9000 ft., June 6; ♂ ♀, Yangtze Valley, Gadsze, 6600 ft., June 21; ♂, Mekong-Yangtse divide, near Weihsi, 7700 ft., June 26; ♂, Mekong River, near Shawatsun, 6200 ft., June 29; 2 ♂, 1 ♀, Yungning, 9500 ft., June 20 (*Ward*).

Not differing from Indian specimens.

Pieris rapæ crucivora.

♂ ♀. *Pieris brassicæ*, var. *crucivora*, Boisduval, Spec. Gen. Lep. p. 521 (1836): Japan.

♂ ♀, N. of Tali, near Chianchuanchow, 7700 ft., June 9; ♂, Likiang, 8200 ft., June 18; ♂, Yangtze Valley, Gadsze, 6600 ft., June 21; ♂, Mekong Valley, near Shawatsun, 6200 ft., June 29.

All smaller than Leech's series from Szechuan and Hupeh, but agreeing with them in the yellow black-sprinkled suffusion from the base of fore wing underside above and within the cell.

Pieris canidia.

Papilio canidia, Sparrman, Amœn. Acad. vii. p. 504 n. (1768): Canton.

♀, Salween, May 21; 2 ♂, 2 ♀, Salween Valley, Chuentang, 7000 ft., May 27; ♀, Loma River, Chientsou, 6700–7000 ft., June 8; 3 ♂, Mekong Valley, S. of Atuntze, June 3–11; ♂, Weihsi River, June 28; 3 ♂, 1 ♀, Mekong Valley, near Nantao, 6400 ft., July 2; 4 ♂, Jugeh River, 7000–9500 ft., July 28; ♀, Yangtze Valley, 7000 ft, August 3.

All belong to the Indian form with shorter broader wings, and more distinct black spots above, with the lower one partially present in the ♂ and not merely showing through from the underside (*indica*, Evans, types from Naini Tal), rather than to typical *canidia* from S.E. China.

Sparrman described *canidia* from "Nord Eyland, Java," but he had come straight from Canton and there can be little doubt that is where he took it between August 1766 and January 1767.

Pieris melete australis.

Pieris melete australis, Verity, Rhop. Pal. p. 331, pl. lii. figs. 14, 15 ♂, 16 ♀ (1911): Yunnan (Tali).

2 ♂, 1 ♀, Jugeh River, 7500–9500 ft., June 28–29; ♀, Yangtze Valley, near Chitien, 7000 ft., August 3.

Both pairs are of the summer form, and agree well with 3 ♂, 2 ♀, from Upper Burma.

Pontia daplidice amphimara.

Leucochloe daplidice amphimara, Fruhstorfer, Ent. Zeitschr. Stuttg. xxii. p. 50 (1908); Verity, Rhop. Pal. p. 327, pl. xxx. figs. 15 ♂, 16 ♀ (1911): Szechuan.

♂, N. of Tali, W. of Yangtsien, 8000–10,000 ft., June 8; ♂, N. of Tali, near Chienchuanchow, 7700 ft., June 9; ♂, Yangtse Valley, between Likiang and Weihsi, May–June 1921 (*Lewer*).

Huphina nerissa.

♂. *Papilio nerissa*, Fabricius, Syst. Ent. p. 471 (1775): [S.E.] China.
♂ ♀. *Appias dapha*, Moore, Proc. Zool. Soc. Lond. 1878, p. 838: Burma.

♂ ♀, Yungchang, 5500 ft., May 24; ♀ (worn), E. of Pupiao, 4400 ft., May 23.

These specimens are intermediate between the small Burmese form *dapha*, Moore, and the typical *nerissa* of S.E. China with which two pairs taken at Mengtze by La Touche agree. This typical form had already in the eighteenth century received three names (*nerissa*, *amasene*, Cram., and *coronis*, Cram.), but all refer to the w.s.f. The very distinct d.s.f. in which the veins are not black above (though the apex of fore wing is more heavily black) and the underside is uniformly brownish or ochreous has never been named, and I propose to call it form *prætermissa*, nov.

Types ♂ ♀ from Hong Kong in B.M., taken in March and November respectively.

Delias subnubila perspicua.

♂ ♀. *Delias sanaca*, var. *subnubila*, Leech, Butt. China, ii. p. 421, pl. xxxvii. figs. 7 ♂, 8 ♀ (1893): Szechuan.
♂ ♀. *Delias belladonna perspicua*, Fruhstorfer, Seitz's Macrolep. ix. p. 130, pl. lvi. A, ♀ (1911): Upper Burma.

14 ♂, Mekong Valley, above Luchang, 4500 ft., May 28; 2 ♂, Lanchow, Loma Valley (trib. Mekong), 7000–8000 ft., June 5, 1 ♂, Yangtze Valley, Beta, June 22; 1 ♂, Mekong Valley, near Yeichih, 6400 ft., July 1; 1 ♂, Jugeh Valley (trib. Yangtze), 7000–9500 ft., July 28; 1 ♀, Mekong Valley, 5000 ft., May 3 (*Ward*).

These Yunnan specimens are decidedly *perspicua* rather than *subnubila*, which Leech had from Szechuan in two forms, a dark and a light, agreeing in the genitalia and linked by an intermediate. Dr. Jordan, in a recent study of the *belladonna* group (Novit. Zool. xxxii. pp. 277 *seq.*), places *perspicua* under *sanaca*, M., from the West Himalaya, but separates *subnubila* as a species on its genitalia. The dark form *adelma*, Mitis, from Hupeh, he places under *berinda*, Moore, from Assam; and the Formosan *wilemani*, Jordan (*taiwana*, Wileman, pt.), he also holds separate.

While completely assenting to the work on the genitalia of this distinguished entomologist, we hold that to make such differences the sole criterion of specific distinctness creates confusion, and in this case hold that the differences are racial only. Judging by the ♀♀, it seems to us that from *perspicua* (or possibly even *sanaca*) in the west to *wilemani* in the east there is a perfectly natural gradation of these various-named forms, all of which differ from *belladonna* in having the large yellow spot near the base of the hind wing on their underside pointed externally.

Delias patrua.

♂ ♀. *Delias patrua*, Leech, Ent. xxiii. p. 46 (1890); id. Butt. China, ii. p. 422, pl. xxxvii. fig. 1 ♂, 2 ♀ (1893): Hupeh (Changyang).

2 ♂, Yangtze Valley, near Shihku, 6000 ft., June 19.

Leech had a long series from Changyang and Ichang, but no Szechuan specimens. Two other Yunnan ♂ ♂, taken at Tseku by Dubernard, are in the B.M.

Delias lativitta.

♂. *Delias patrua*, var. *lativitta*, Leech, Butt. China, ii. p. 422, pl. xxxv. fig. 1 (1893): Szechuan (Moupin and Tatsienlu).

1 ♂, Weihsi River (trib. Mekong), 7000 ft., June 28.

We follow Dr. Jordan (*loc. cit.*) in considering this certainly distinct from *patrua*. It seems to be the least common of the Chinese species of this group, but extends to Formosa.

Ixias pyrene yunnanensis.

♀. *Ixias* [*pyrene*], subsp. *yunnanensis*, Fruhstorfer, Soc. Ent. xvii. p. 81 (1902): Yunnan (Mengtze).

♂, Luchang to Feilung, 4500 ft., May 29 (wet-season form).
♀, Yungchang, 5000 ft., May 24 (dry-season form).

Gonepteryx amintha.

♂. *Rhodocera amintha*, Blanchard, Comptes Rendus, 1871, p. 810 n.: Szechuan (Moupin).

♂, Mekong Valley, S. of Atuntze, July 3. Rather small.

Gonepteryx aspasia alvinda.

♂. *Rhodocera alvinda*, Blanchard, Comptes Rendus, 1871, p. 810 n.: Szechuan (Moupin).

♂, Mekong-Yangtze divide near Atuntze, 12,000 ft., July 20.

Colias fieldii.

♂. *Colias fieldii*, Ménétriès, Enum. Ins. Lep. Petr. i. p. 79, pl. i. fig. 5 (1855): [E.] Himalaya.

♂, Yungchang, 5500 ft., May 24; ♂, Yangtze Valley, between Likiang and Weihsi, May (*Lewer*); 2 ♂, Loma Valley, Chientsao,

5700–7400 ft., June 2; 3 ♂, Likiang, 8200 ft., June 15; ♂ ♀, Yungning, 9500 ft., June 30 (*Ward*).

All are typical *fieldii*, the Yungning pair, perhaps from the higher elevation, are the smallest.

Colias hyale sinensis.

♂ ♀. *Colias hyale sinensis*, Verity, Rhop. Pal. p. 349, pl. lxix. figs. 19–21 (1911): Kiangsi (Kiukiang).

3 ♂, Jugeh River, 7000–9500 ft., July 28.

2 ♀, Yungning, 9500 ft., June 30 (*Ward*).

All the specimens are worn. They appear to be more like the Himalaya form *glicia*, Fruh., than the bright yellow and sometimes gigantic form from Szechuan, which Fruhstorfer called *pyxagathus* and Verity *immanis*. Both the ♀ ♀ are yellow. The type of Verity's *sinensis* is a large ♂ of the summer brood much resembling the same brood (*simoda*) of the Japanese *poliographus*, from which he separated it on the ♀ coloration.

Terias hecabe.

♂. *Papilio hecabe*, Linné, Syst. Nat. (ed. 10) i. p. 470 (1758): "Asia" [S.E. China].

♂, Yungchang, 5500 ft., May 24; ♂, Mekong–Yangtze divide near Atuntze, 11,000 ft., June 19; 10 ♂, 4 ♀, near Weihsi, 6200–7700 ft., June 26–28; ♂ ♀, Mekong Valley, near Shawatsun, 6200 ft., June 29; 3 ♂, 2 ♀, Mekong Valley, near Nantao, 6400 ft., July 2; ♂ ♀, Jugeh River, 8500 ft., July 28–29; 4 ♂, 1 ♀, Jugeh River, Sekon, 7300 ft., July 30; 6 ♂, Tacheng, 7300 ft., Aug. 1; 2 ♂, Yangtze Valley, near Chitien, 7000 ft., Aug. 3; 1 ♂, 2 ♀, without locality.

The uppersides vary considerably in extent of border in both sexes, but all have the very slightly marked underside which seems to be characteristic in W. and C. China, however "dry" the upperside may be, and in marked distinction to the very heavily marked ferruginous underside of "dry" typical *hecabe* from Hong Kong region.

Terias anemone.

♂. *Terias anemone*, Felder, Wien. Ent. Monat. vi. p. 23 (1862): Chekiang (Mts. near Ningpo).

♂, Mekong Valley, near Weihsi, 7700 ft., June 26.

In spite of the experiments of Pryer, as recorded by Leech (Butt. China, p. 430, *mandarina*), I think it safer for the present to keep *anemone* apart from *hecabe*. In the Leech series of both (*hecabe* 8 ♂, *anemone* 4 ♂, 3 ♀), taken in the same month of September 1887 at the Ichang Gorge (Hupeh), there is no intergrading between the forms, and in the Hong Kong winter series there is a very marked and consistent difference in the maculation of the undersides, the subapical ferruginous blotch of *hecabe* being replaced in *anemone* by a finely drawn line, and there is much

more black irroration. In Japan, where the d.s.f. (*hybrida*) of *hecabe mariesii* has no ferruginous marking, the same differences appear to me to separate it from *anemone mandarina* as in C. China, and I take *connexiva*, Butler, to be the second brood of this.

More breeding experiments are required.

Leptidea gigantea.

♂ ♀. *Leucophasia gigantea*, Leech, Entomol. xxiii. p. 45 (1890): Hupeh (Changyang).

1 ♀, Yunnan, without data; of the spring form (*immacula*, Leech). Leech had the species from Kweichow, but not from Szechuan. The forewings are more pointed than in the Hupeh ♀ ♀, and the subterminal arrow-heads of the hind wings beneath are longer.

Fam. **Papilionidæ.**

Ornithoptera æacus æacus.

Ornithoptera æacus, Felder, Wien. Ent. Monat. iv. p. 225. no. 71 (1860): Bengal.

Papilio minos (nec Cramer), Oberthür, Et. Ent. xi. p. 14 (1886): Szechuan.

♂, Mekong Valley (detailed information as to locality unfortunately lost).

Dr. Jordan, writing in 1908 (Seitz's Macrolep. ix. p. 25), gave the range of *T. æacus æacus* as N. India to W. China, etc. It was obtained in some numbers in W. China by Leech's collectors, but does not appear definitely to have been recorded from the province of Yunnan till now.

[A Yunnan ♂ of *O. helena cerberus*, Felder, taken by La Touche at Laskay, September 29, 1920, is also in the B.M.]

Byasa latreillei genestieri.

Papilio latreillei genestieri, Oberthür, Bull. Soc. Ent. France, 1918, p. 187: Szechuan.

♂, Shuantangchang, Valley of Loma River, 7000–8000 ft., June 4.

Oberthür described this subspecies from a series collected at Siaolu, Changchaupin, and Upper Lutsekiang. He distinguished it by the more blackish (less brown) wings and the additional white spot on hind wing upperside in both sexes. Prof. Gregory's specimens agree admirably in respect to the former character, but the additional white spot is by no means large, and rather diffuse.

Byasa philoxenus lama.

♂ ♀. *Papilio lama*, Oberthür, Et. Ent. ii. p. 15, pl. iii. fig. 1 (1876): Szechuan (Moupin).

♂, Yangtze Valley, N. of Ninkai, 7300 ft., Aug. 12.

♀, Valley of Loma River, Tangweitang, 9600 ft., June 7.

The ♂ is of the form with very reduced and much obscured red marginal marks of hind-wing upperside, and no white patch; the female, on the other hand, has the red marks well developed and a very large white patch in area 5.

Byasa nevilli.

♂. *Papilio nevilli*, Wood-Mason, Ann. & Mag. Nat. Hist. (5) ix. p. 105 (1882): Assam (Cachar).
♂. *Papilio chentsong*, Oberthür, Et. Ent. xi. p. 13, pl. i. fig. 1 (1886): Szechuan (Yerkalo).

2 ♂, 1 ♀, Tacheng, on Chitsung River (trib. of Yangtze), 7300 ft., Aug. 1.

The B.M. has also 2 ♂ taken at Mengtze by La Touche.

All four of the Yunnan ♂ ♂ differ from the Szechuan series (we have no Assam specimens) in the absence of the white androconial wool in the dorsal fold of hind wing, it being replaced by a less amount of greyish wool.

Byasa plutonius plutonius.

♂ ♀. *Papilio plutonius*, Oberthür, Et. Ent. ii. p. 16, pl. iii. fig. 2, ♂ (1876): Szechuan (Moupin).
Byasa alcinous tytleri, Evans, J. Bombay N. H. Soc. xxix. p. 23 (1923): Assam (Naga Hills).

Yangtze Valley, ♂ Beta, ♀ Gadsze to Beta, 7000 ft., June 22. Both specimens are rather worn, and in the paleness of the markings normally red in typical *plutonius* show a slight approach to *tytleri*, Evans, recently described from the Naga Hills, of which the types are in the B.M.

Orpheides demoleus.

Papilio demoleus, Linné, Syst. Nat. (ed. 10) i. p. 464 (1758): "Asia."

2 ♂, Yangtze Valley, 4500 ft., May 17, 1921 (*Ward*).

La Touche had a pair from Mengtze.

Papilio machaon verityi.

Papilio machaon verityi, Fruhstorfer, Ent. Zeitschr. Guben. xx. p. 301 (1907): Yunnan.

♂, Mekong River, near Shawatsan, 6200 ft., June 20.
♂, Menghuating, 7500 ft., May 9, 1921 (*Ward*).

Papilio xuthus xuthus.

Papilio xuthus, Linné, Syst. Nat. (ed. 12) i. (2) p. 751 (1767): "E. India."

♂, near Shihku, Yangtze Valley, June 19; 2 ♂, Gadsze, Yangtze Valley, 6600 ft., June 20, 21; ♀, Weihsi River, 7000 ft., June 22; ♂, near Yeichih, Mekong Valley, 6450 ft., July 1; ♀, Tongchulin, Yangtze Valley, 11,000 ft., July 25; 1 ♂, 2 ♀,

N. of Chitien, Yangtze Valley, 7000 ft., Aug. 3; ♂, Gadsze, Yangtze Valley, 6600 ft., Aug. 6; ♂, N. of Ninkai, Yangtze Valley, 7300 ft., Aug. 13; ♂, locality and date not known.

Differ in no way from Szechuan specimens, of which there is a long series in the B.M. obtained by Leech's collectors.

Tamera polytes polytes.

♀. *Papilio polytes*, Linné, Syst. Nat. (ed. 10) i. p. 460 (1758): "Asia."

♂ ♀, Yangtze Valley, Gadsze, 6600 ft., Aug. 6; 2 ♂, Yangtze Valley, near Shihku, 6400 ft., Aug. 7; ♂, Yangtze Valley, N. of Ninkai, 7300 ft., Aug. 12.

♂, Litang River, Muli, 8000 ft., Aug. 8, 1921 (*Ward*).

The female is of the typical ♀ form *polytes*. The males, although taken in August, all have well-developed red submarginal spots on the underside of the hind wings and are therefore referable to form *borealis*, Felder.

Iliades protenor protenor.

♂. *Papilio protenor*, Cramer, Pap. Exot. i. p. 77, pl. xlix. figs. A, B (1775): [S.E.] China.

♂, Tacheng, Yangtze Valley, 7300 ft., July 30.

♀, Weihsi River (trib. of Mekong), 7000 ft., June 28.

The ♂ is very sparsely sprinkled with blue scales in areas 5–7 of hind wing upperside. On this character the supposed subspecies *euprotenor*, Fruhst., was founded. But, inasmuch as the typical *protenor* appears to be equally as common as the blue-scaled form in W. China, it seems best to treat the latter as a form of *protenor protenor*.

Achillides bianor bianor.

♀. *Papilio bianor*, Cramer, Pap. Exot. ii. p. 11, pl. ciii. fig. C (1777): [N.E.] China.

♂, Luchang, Mekong Valley, 4500 ft., May 29.

Quite typical, except for the unusual narrowness of the androconial stripes, but rather small.

Dalchina cloanthus cloanthus.

Papilio cloanthus, Westwood, Arc. Ent. p. 42, pl. xi. fig. 2 (1845): N.E. India.

Papilio cloanthus, var *clymenus*, Leech, Butt. China, p. 523, pl. xxxii. fig. 2 (1893): Hupeh (Changyang).

♂, Gadsze, Yangtze Valley, 6600 ft., Aug. 6.

The single ♂ brought back is not nearly so heavily black-margined as are Leech's *clymenus*, which came from Changyang, Central China, and in fact is not distinguished from the summer form *cloanthulus*, Fruhst., from North India. In the tint of the translucent green areas of the wings, however, it shows some approach towards *cloanthus clymenus*, whilst the translucent spot

at the base of area 3 of hind wing, which seems invariably to be absent in *clymenus*, is present in this specimen as in the vast majority of N. Indian *cloanthus*.

Pathysa alebion parus.

Papilio parus, de Niceville, Journ. Bomb. N. H. Soc. xiii. p. 172, pl. E.E. fig. 20, ♂ (1900): Yunnan (Tseku).

♂, Litang River, Muli, 7000 ft., May 19 (*Ward*).

Not differing markedly from *tamerlanus*, Ob., from Szechuan.

Pathysa glycerion mandarinus.

♂. *Papilio glycerion mandarinus*, Oberthür, Et. Ent. iv. p. 115. n. 165 (1879): Szechuan (Moupin).

♀, Litang River, Muli, 8000 ft., July 1, 1921 (*Ward*).

Agrees with one of Leech's ♀♀ from Szechuan.

[*Parnassius hannyngtoni.*

♂♀. *Parnassius hannyngtoni*, Avinoff, Trans. Ent. Soc. Lond. 1915, p. 351: S.E. Thibet (Kangma).

♂, Tsangpo Valley, Dyara, 14,500 ft., April 14, 1924 (*Ward*).

This distinct little species has now been taken by the Mt. Everest expeditions at several localities in S.E. Thibet and Chumbi at elevations of 14,000–17,000 ft.

So far as at present known, it has one brood only, and that very early in the year for an alpine species (April–May).]

Parnassius imperator.

♀. *Parnassius imperator*, Oberthür, Bull. Soc. Ent. Fr. 1883, p. 76; id. Et. Ent. ix. p. 17, pl. i. fig. 4 (1884): Szechuan (Tatsienlu).

♀, Mekong Valley, 8000 ft., Aug. 24 (*Ward*).

Parnassius epaphus poeta.

♂. *Parnassius poeta*, Oberthür, Et. Ent. xvi. p. 2, pl. ii. fig. 9 (1892): Szechuan (Mts. near Tatsienlu).

♀, Litang River, 10 miles S.W. of Muli, 14,000–15,000 ft., July 31, 1921 (*Ward*).

Fam. **Hesperiadæ.**

Achalarus bifasciatus contractus.

♂♀. *Achalarus bifasciatus contractus*, Leech, Butt. China, p. 560, pl. xxxviii. fig. 9, ♂ (1893): Szechuan.

♂♀. Mekong Valley, Weihsi, 7700 ft., June 24 and 26.

Agree with Leech's series.

Augiades subhyalina thibetana.

Pamphila subhyalina, var. *thibetana*, Oberthür, Et. Ent. xi. p. 28, pl. vi. fig. 45 (1886): Szechuan (Tatsienlu).

2 ♂, Mekong Valley, near Nantao, 6400 ft., July 2; ♀, Tacheng, 7300 ft., Aug. 1.

Pamphila abax.

Carterocephalus abax, Oberthür, *loc. cit.* p. 27, pl. v. fig. 27 (1886): Szechuan (Tatsienlu).

♂, Yangtze Valley, S. of Hoching, 10,000 ft., Aug. 11.

[*Pamphila houangty shoka.*

♂. *Pamphila houangty shoka*, Evans, Journ. Bomb. N. H. Mus. xxiii. (3) p. 546, fig. (1915): S.E. Thibet.

♂, Tsangpo Valley, Gyala, 9000 ft., July 20, 1924 (*Ward*). Agrees with the type taken by Bailey, also at 9000 ft., in the neighbouring Pochu Valley, June 27, 1913.]

Padraona dara flava.

Pamphila flava, Murray, Ent. Mo. Mag. xii. p. 4 (1875): Japan.

♂, Yangtze River, N. of Chitien, 7000–8000 ft., Aug. 2.

Halpe sp.

A worn ♂ without data. I cannot be certain of the identification, but it comes near to *blanchardi*, Mabille, from Szechuan (Moupin).

XXXIV.—Koremagraptus *, *a new Dendroid Graptolite.* By O. M. B. Bulman, Ph.D., D.I.C., A.R.C.S.

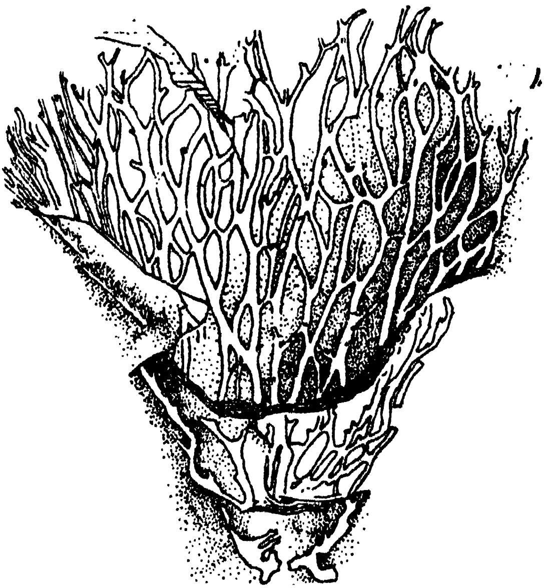
[Plate IV.]

The specimen here described was collected from the Silurian of the well-known Onny River Section, Shropshire, by Dr. W. F. Whittard, who kindly gave it to the writer. Although the shale is somewhat weathered, the stipes and thecal tubes are mostly preserved in relief (being infilled with pyrites), and commonly show growth-lines. The structure is therefore readily seen in an etched preparation, but the shale crumbled so rapidly on wetting that only relatively small

* Gr. κόρημα, a brush.

portions of the branches were left adhering to the Canada balsam *.

The genus combines the form of stipe and thecal structure of the *Inocaulis-Acanthograptus* group with the habit of the *Dictyonema-Desmograptus* group. "Species no. V" of Wiman † apparently belongs to this new genus.



Koremagraptus onniensis, × 3.

Nearly complete rhabdosome, showing general form. Ungrouped thecæ can be seen at various points where the inner surface of the rhabdosome is exposed (in the upper portion of the figure).

Provisional Generic Diagnosis.—Rhabdosome conical; branches complex; thecæ tubular (cylindrical), some opening singly along the inner side of the branches, others detaching themselves in groups of three or four to form twigs; branches and twigs anastomosing irregularly.

By analogy with "species V" of Wiman, it is probable that the visible thecæ include "gonangia" as well as hydrothecæ, but these cannot be distinguished by their external characters.

* The technique adopted was that described by Holm (Bihang K. Svenska Vet.-Akad. Handl. vol. xvi. Afd. 4, p. 9) and Walton (Ann. Botany, vol. xxxvii. p. 382).

† Bull. Geol. Inst. Upsala, no. 6, vol. iii. p. 361.

Specific Diagnosis.—Length of rhabdosome 2·5+ cm.; branches somewhat sinuous, with a string-like appearance due to the numerous, long, tubular thecæ; varying in width; twigs more slender than the branches, themselves anastomosing or uniting with adjacent branches, the resulting mesh being very irregular; thecæ may number twenty to the cm. along the inner side of the branches, about 0·15 mm. in diameter, projecting free distally for $\frac{1}{4}$–$\frac{1}{2}$ mm.

Anastomosis may involve merely the temporary fusion of two twigs or branches, or a twig and a branch, but commonly one or more thecæ are carried over from one component into the other, and this may lead to a reversal of the relative thickness of two anastomosing branches.

Type-specimen.—No. 71 in the collection of the writer.

Horizon and Locality.—Upper Valentian (Purple Shales*), River Onny, Shropshire.

Remarks.—Wiman has shown † that in a typical species of *Dictyonema* three types of individual are present. One of these three—the budding individual—never opens to the exterior; the remaining two, designated thecæ and gonangia respectively, open to the exterior distally, but differ markedly in their appearance. The thecæ are conspicuous, usually with an apertural spine, and generally reminiscent of the thecæ of the Graptoloidea, while the gonangia are often very difficult to detect even in etched specimens. In crushed or flattened specimens, therefore, it may only be possible to see the thecæ, in which case the appearance of a stipe approaches that of a true graptolite.

In the genus *Inocaulis* the branches consist of compact bundles of numerous tubular thecæ, which project distally from the branch like the bristles of a brush—see the description given by Ruedemann ‡ of *I. lesquereuxi* (Grote and Pitt). The detailed structure of *Inocaulis* is still unknown, but in *Acanthograptus suecicus* (Wiman), where fewer individuals compose the branches and the thecæ open in groups or twigs only, Wiman has shown § that three types of individual are present, precisely as in *Dictyonema*, with the distinction that here the thecæ and gonangia are almost identical in outward form.

Between these two types of thecal form is a series of morphological intermediates, in which the present genus takes

* The stratigraphical division corresponds to that already given for the Wrekin area (Whittard, Proc. Geol. Assoc. vol. xxxvi. p. 378).

† Bull. Geol. Inst. Upsala, no. 4, vol. ii., no. 5, vol. iii., no. 6, vol. iii.

‡ Bull. New York State Mus. no. 189, pp. 13–17, pl. iv.

§ Bull. Geol. Inst. Upsala, no. 4, vol. ii. pp. 63–65.

its place. *Desmograptus* may apparently be regarded as a *Dictyonema* in which anastomosis has been partly or completely substituted for the dissepimental connection of the stipes. In *Reticulograptus*, Wiman *, which resembles *Desmograptus* in general form, the thecæ are elongated and freed distally from the branches, projecting as short spined tubes. Structurally *Koremagraptus* occupies an intermediate position between the latter genus and *Acanthograptus*. The conical rhabdosome, anastomosing branches, and the solitary tubular thecæ along the inside of the branches recall the structure of *Reticulograptus*, but the tubular character of the thecæ is more pronounced, and they are frequently detached from the branches in small groups or twigs, as in *A. suecicus*; further, it possesses quite distinctly the fasciculate *Acanthograptus* type of branch. From *Palæodictyota*, Whitfield, emend. Ruedemann †, it is to be distinguished by its projecting thecæ.

The writer desires to express his thanks to Dr. G. L. Elles and Dr. R. Ruedemann for kindly reading the manuscript of this paper and for their valued advice.

Since writing the above, the author has received from Dr. Poulsen a description ‡ of another new graptolite genus—*Syrrhipidograptus*. Whilst of a more simple structure throughout, the branches being uniserial, this genus presents many points of similarity, and a branch of *Syrrhipidograptus* would appear to be comparable in some ways with a connecting twig of *Koremagraptus*.

EXPLANATION OF PLATE IV.

Figs. 1, 2. Complex branches, showing string-like appearance and long tubular thecæ; groups of four individuals marked "*x*" (fig. 1) and "*y*" (fig. 2) probably represent broken twigs. (Etched specimen.)

Fig. 3. A small branch with three twigs, A (broken), B, and D. The twig B anastomoses with one (C) from the adjacent branch, separation being apparently effected without interchange of individuals. (Etched specimen.)

Fig. 4. A twig serving to connect two adjacent branches, that on the right being represented by an external mould; that on the left possesses four thecæ opening singly along the branch.

Fig. 5. A laterally compressed connecting twig, showing projecting tubular thecæ.

Figs. 1–3 & 5, × 15; fig. 4, × 13 (approx.).

* *Op. cit.* no. 10, vol. v. p. 189.
† New York State Mus. Mem. xi. p. 198.
‡ Medd. f. Dansk geol. Forening, Bd. vi. no. 25 (1924).

XXXV.—*On the Structure of the Branchiæ of the Gilled Oligochæte* Alma nilotica. By R. Gresson, B.Sc.

(From the Department of Zoology, University of Edinburgh.)

I. Introduction.

The gilled Oligochæta are very rare, a few genera only being known; for a long time *Dero* was the only Oligochæte known to possess special respiratory organs, but more recently others have been added to the list, which now comprises the following:—

The closely related genera *Dero* and *Aulophorus* (Naididæ).
The genus *Branchiodrilus* (Naididæ).
Branchiura sowerbyi (Tubificidæ).
Hesperodrilus branchiatus (Phreodrilidæ).
Alma nilotica and *a. eubranchiata* (Glossoscolecidæ).

In the genus *Dero* and *Aulophorus*, which are common inhabitants of pools etc., the branchial processes are at the posterior end of the body; they are ciliated processes of the body-wall which arise from the inner wall, or margin, of the branchial fossa, and are hollow, the cavity being in communication with the cœlom.

The vascular supply consists of a loop in each gill; the loops originate from the hind end of the ventral vessel, and end by joining to form the dorsal vessel, but the exact disposition and the degree of complication vary in the several species.

Branchiodrilus is found in several places in India, in Java, and (along with *Branchiura sowerbyi*) in the Victoria Regia tank in the Royal Botanic Society's garden in Regent's Park.

The gills are described by Beddard (3) as being a double series of long hollow processes of the integument which enclose the dorsal setæ in the anterior segments; posteriorly some of the setæ are not enclosed.

The hollow of each process communicates with the cœlom; the walls are formed of epidermis alone, the muscular layers of the body-wall being apparently not prolonged into it; there is a cuticle on the outside. Each process contains a vascular loop, which is derived from the circular vessel uniting the dorsal and ventral vessels.

The gills of *Lahoria hortensis* (which is now united with *Branchiodrilus*) are similar in structure and were originally described by Stephenson (11).

Branchiura sowerbyi occurs in India (12) and the Far East ; it has been found in warm houses in several cities of Europe and in the river Rhone.

Fig. 1.

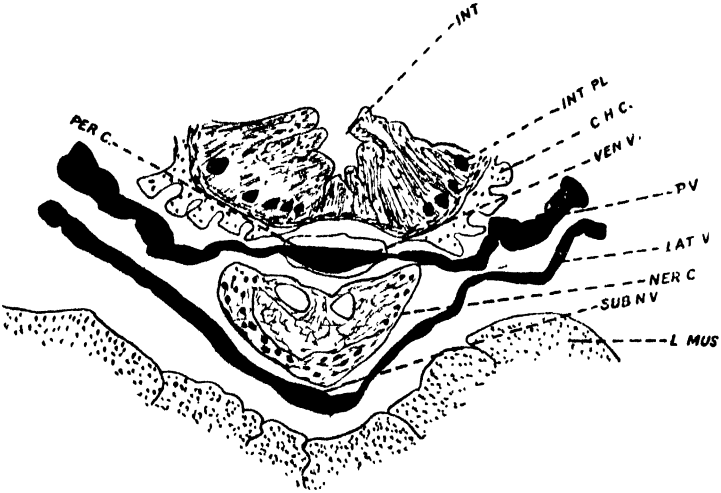
Transverse section through posterior part of body, showing branchiæ and their blood-supply; diagrammatic. × 35.

AF.C. = afferent capillary ; AF.B.V. = Dorsal part of parietal vessel ; EF.C. = efferent capillary ; EF.B.V. = efferent vessel ; EP. = epithelium ; CP.L. = capillary loop ; C.MUS. = circular muscle-layer ; CH.C. = chloragogen cells ; DOR.V. = dorsal vessel ; D.INT.V. = dorso-intestinal vessel ; INT. = intestine ; INT.PL. = intestinal plexus ; L.MUS. = longitudinal muscle-layer ; LAT.V. = commissural vessel ; M.DG. = mid-dorsal groove ; SUB.N.V. = subneural vessel ; VEN.V. = ventral vessel ; P.V. = parietal vessel.

The gills (2) consist of a series of pairs of cylindrical processes arising from the mid-dorsal and mid-ventral lines at the posterior end; each branchia has a capillary loop lying beneath the epidermis and a layer of muscles; the circular muscle-layer enters the gills, but not the longitudinal layer. The cavity is shut off from the general body-cavity by a diaphragm.

Hesperodrilus branchiatus (3). The branchial processes are like those of *Branchiura*, but are dorso-lateral in position.

Fig. 2.



Transverse section showing ventral and subneural vessels. × 73.

CH.C. = chloragogen-cells; INT. = intestine; INT.PL. = intestinal plexus; LAT.V. = commissural vessel; NER.C. = nerve-cord; P.V. = parietal vessel; PER.C. = peritoneal cells.

In *Alma eubranchiata*, which occurs in the Belgian Congo and was originally described by Michaelsen (8), the last 100 segments have gills which are situated on the dorsal surface, medial from the dorsal setæ, on each side of the mid-dorsal groove.

Each segment bears one pair of gills; the most anterior are simple, but further back they become more complicated, pushing out processes and finally becoming dendritic.

Michaelsen (7) briefly describes the gills of *Alma nilotica* as tubular evaginations of the body-wall, in which the muscular

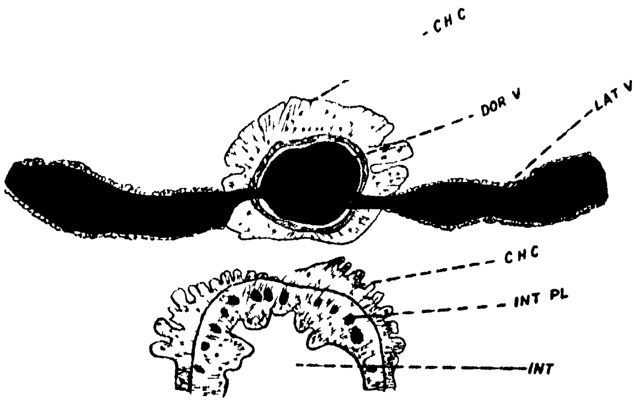
layers participate only to a small degree. A blood-vessel enters each gill and branches within it ; another blood-vessel is formed by the junction of these twigs and brings the blood back from the gills into the body.

Rea (9), in a brief note on the structure of *Alma nilotica,* similarly describes the gills as outpocketings of the body-wall, taking with them the layer of circular muscle, but not the longitudinal muscle; they are provided with afferent and efferent blood-vessels ; the epithelium of the gills and of the whole body is highly vascular.

II. Material and Methods.

The material was sent for examination to Dr. J. Stephenson by Dr. E. Hindle, of the Medical School, Cairo, where it is

Fig 3.



Transverse section showing dorsal vessel and part of intestinal plexus. Lettering as in figs. 1 & 2. × 73.

used as a type for dissection in the junior class. I wish to thank Dr. J. Stephenson for his many useful suggestions concerning this work.

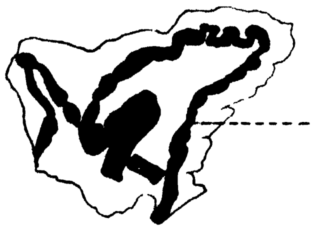
The worms were in two batches, one lot being sexually mature, while the others were not ; both lots were fixed in formalin and subsequently transferred to, and preserved in, 90 per cent. alcohol. The sexually mature individuals were fed on coffee-grounds previous to fixation, so that the gut was cleared for convenience in sectioning.

Before cutting sections, the general structure and arrangement of the branchial processes were made out under the

dissecting binocular. Thick sections were cut by hand with a razor ; some of these were stained with hæmatoxylin and eosin, while others were cleared in acetic acid without staining; both these methods proved very useful for making out the general arrangement of the blood-vessels. Some of the branchial processes were cleared in the same way, but only one of these (fig. 4) showed the course of the whole vascular loop.

Transverse and longitudinal sections of the posterior gill, bearing part of the body, were cut ; most of these were 10 μ thick, as it was found that the vascular system could be best made out in sections of this thickness. One series of transverse sections was cut at 5 μ ; these showed the structure of the epithelium very well and the arrangement of the vascular

Fig. 4



Branchial process cleared in acetic acid.

B.V.=Vascular loop.

loop in the branchial processes. Hæmatoxylin and eosin was found to be the best stain; eosin being a specific stain for hæmoglobin, the blood in the vessels was deeply stained.

III. Descriptive.

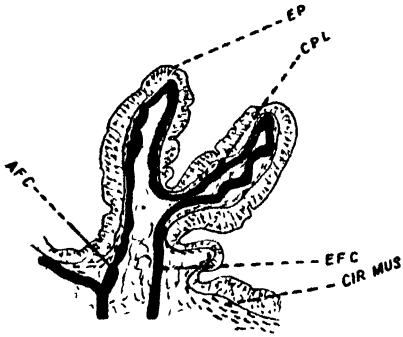
Alma nilotica, first described in 1855 by Grube (5), occurs abundantly in Lower Egypt in the Nile mud deposited in ditches, tanks, etc. It appears to become sexually mature in spring (Michaelsen (6)), when the ditches and tanks dry up, and probably lives only for one year, the life of the species being carried on by the young enclosed in the cocoon which survives the time of the drying up of the mud.

The posterior part of the body on which the gills occur (fig. 1) is four-cornered, the ventral surface being nearly flat, while the dorsal surface is marked by a groove, the mid-dorsal groove (M.DG., fig. 1).

1. *Description of the Branchial Processes as seen under the Dissecting Binocular.*

The gills occur segmentally on the posterior fourth of the body, except the last 6–7 segments. They form a double series, one on each side of the segment, extending in a narrow row from the dorso-lateral margin to the mid-dorsal groove, in which there are no processes. Towards the anterior limit of their extent they consist of minute papilliform projections, 1–2 on each side of each segment; in succeeding segments they increase in size and form a transverse row. Each row consists of about five branchial processes, many of which are branched, while some are slightly bifid at their free ends; in some cases 2–3 processes

Fig. 5.



Branchial process, bifid at the tip. × 73.

AF.C. = afferent capillaries; EP. = epithelium; CP.L. = vascular loop; CIR.MUS. = circular muscles.

are united together at their base. Towards the posterior limit of their extent, with the narrowing of the body, each row comes to consist of fewer branchial processes.

The processes vary in size from small papilliform projections to about 0·5 mm. in length.

2. *The Body-Wall*

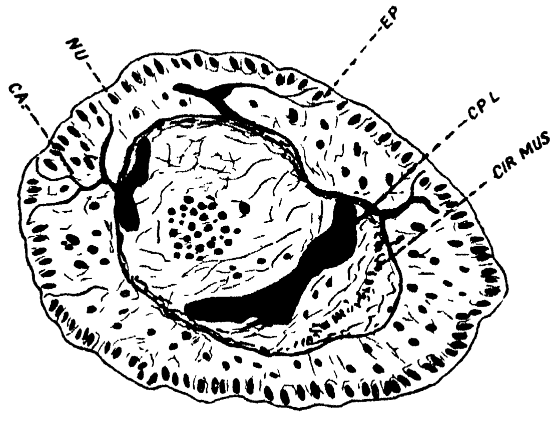
consists of a thin cuticle, an epithelial layer, a basement-membrane, and circular and longitudinal muscle-fibres.

The epithelium of the general surface (fig. 1, E.P.) varies from about 36 μ–90 μ in thickness. It consists of columnar cells with elongate nuclei; in the deeper part of the layer there are other cells which are not columnar and which have

spherical nuclei. Small capillaries pass between the cells towards the surface (fig. 7). Large granular secretory cells, which stain darkly with hæmatoxylin, occur scattered among the other cells; they open on the surface. In the outer margin of the epithelial cells there are a number of small round clear spaces which seem to occur all round the body, but are more numerous towards the dorsal surface; these probably contained secretory matter which has been discharged.

The circular muscle-layer (fig. 1, C.MUS.) varies from about 20–70 μ in thickness, being thickest in the ventral and

Fig. 6.



Transverse section of branchial process showing capillaries in epithelium. × 300.

CA. = capillary in epithelium. Other lettering as in fig. 5.

dorsal parts of the body-wall; a very thin layer of muscle-fibres is continued from the circular muscle-layer into the branchial processes, where they run in a layer of connective tissue just internal to the epithelium.

The longitudinal muscle-layer (fig. 1, L.MUS.) is internal to the circular muscle-layer; it varies from about 100–36 μ in thickness, the greatest thickness being in the ventral part of the body-wall. A definite peritoneal layer is distinguishable lining the cœlom.

3. *Histology of the Branchial Processes.*

(*a*) The epithelium of the general surface is continued into that of the branchial processes; here it is not so thick, being about 36–40 μ in height (figs. 1, 5, 6, 7, EP.).

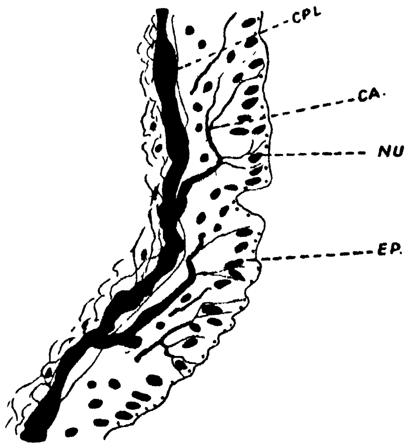
The large granular type of secretory cells are not so numerous as in the body-wall, but there are a number of small clear spaces towards the outer margin of the columnar cells.

The epithelium of the branchial processes is very vascular, numerous small capillaries passing between the cells almost to the surface; a thin basement-membrane is present.

(*b*) A very thin layer of muscle-fibres is continued from the circular muscle-layer of the body-wall into the branchial processes (fig. 5, CIR.MUS.), where they run in a layer of connective tissue just internal to the epithelium.

(*c*) There are no longitudinal muscle-fibres in the branchial processes.

Fig. 7.



Longitudinal section showing epithelium of gill.
Lettering as in figs. 5 & 6. × 300.
NU. = nuclei of cells.

(*d*) The cavities of the branchiæ communicate with the cœlom by means of a space situated in the longitudinal muscle-layer below each group of branchial processes; this space opens into the cœlom (figs. 9, 10).

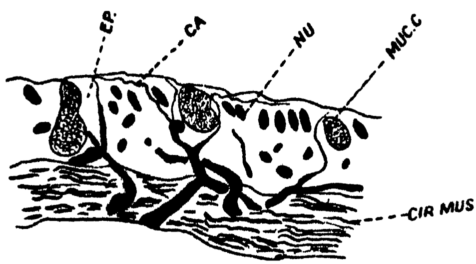
The cavity of the branchia is traversed by strands of tissue and contains nucleated corpuscles, which are roughly circular in outline and about 4 μ in diameter; each corpuscle contains a single large nucleus which is deeply staining and somewhat rounded or slightly elongate in shape. The corpuscles resemble those of the body-cavity, most of which, however, are larger, being about 5–6 μ in diameter; they are evidently cœlomic corpuscles which have passed into the

gills from the cœlom by the connection in the longitudinal muscle-layer.

(*e*) The vascular loop (figs. 1, 5, 6, 7, CP.L.) present in each of the branchial processes is about 4–8 μ in diameter, but may be more, where distended with blood. It arises as a branch of the main afferent vessel (fig. 1, AF.B.V.); the branch (fig. 1, AF.C.) may divide into two at the base of the gills, in this way supplying two branchiæ; in other cases it does not divide and only gives rise to the vascular loop of a single branchial process.

It was observed that in the branchial processes, which were bifid at their free ends, the vascular loop of one branch passed directly into, and formed the loop of, the second branch so that the blood-supply of both branches of the process was derived from the same loop.

Fig. 8.



Epithelium of general body-surface, showing capillaries. × 300.
NU. = nucleus of epithelial cell; MUC.C. = mucus cell.
Other lettering as before.

The vascular loop runs internal to the epithelial layer, as far as the distal end of the branchial process, and returns on the opposite side of the process to its base; from this loop a number of small capillaries (figs. 6, 7, CA.) are given off which become further subdivided as they pass towards the surface of the epithelium; they form a branching network, which extends between the epithelial cells; the blood in this network passing from and to the main loop, perhaps several times as it traverses the gill; passing slowly through the network it comes to within a short distance of the surface, where it becomes aerated.

The efferent branchial vessel (fig. I, EF.B.V.) takes its origin from the other end of the loops.

4. *The Circulatory System in relation to the Gills.*

(*a*) The Dorsal Vessel (figs 1, 3, DOR.V.) lies on the intestine in the mid-dorsal line; it is greatly dilated with

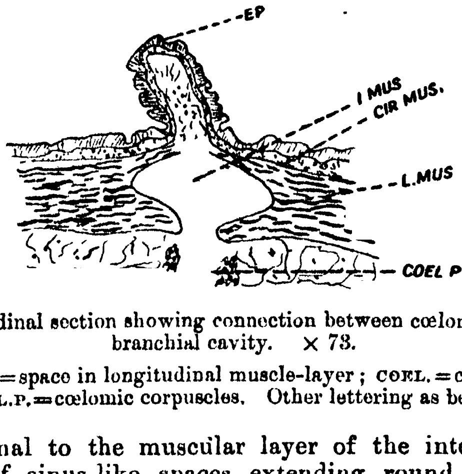
blood, but becomes reduced in size before passing through the septa; it is covered over on the outside by chloragogen cells (fig. 3, CH.C.) similar to those occurring on the wall of the intestine.

(*b*) The Ventral Vessel (figs. 1, 2, VEN.V.) is situated below the intestine; it was contracted in the specimens examined, being about 90 μ in diameter, and about 180 μ from side to side; it also becomes constricted on passing through the septa.

(*c*) The Subneural Vessel (figs. 1, 2, SUB.N.V.) is very small, being only about 20 μ in diameter; it is situated just below the ventral nerve-cord, and is covered on the outside by peritoneal cells. Only a small number of sections showed the subneural vessel, as in most cases it was empty of blood.

(*d*) The Intestinal Plexus (figs. 1, 2, 3, INT.PL.) occurs

Fig. 9.



Longitudinal section showing connection between cœlom and the branchial cavity. × 73.

I.MUS. = space in longitudinal muscle-layer; COEL. = cœlom; COEL.P. = cœlomic corpuscles. Other lettering as before.

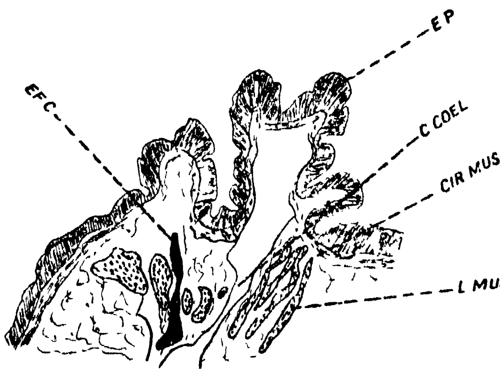
just internal to the muscular layer of the intestine as a number of sinus-like spaces extending round the whole intestinal wall; they seem to be most numerous in the dorsal part.

The intestinal plexus is connected with the dorsal vessel by two transverse vessels (fig. 1, D.INT.V.) in each segment which take their origin from the ventral third of the gut-wall, but are connected with the other spaces as they pass towards the dorsal vessel into which they open; each vessel is bent on itself as it proceeds dorsalwards. The plexus is connected with the ventral vessel by a vessel which is given off from the dorsal part of the latter. The two transverse vessels are covered over by the same kind of elongate chloragogen-cells as occur on the dorsal vessel and intestinal wall.

(*e*) The Commissural Vessels (fig. 1, LAT.V.) are loops between the subneural and dorsal vessels; each vessel proceeds towards the dorsal surface, but before reaching the longitudinal muscle-layer it receives the main efferent branchial vessel and at the same time turns sharply towards the middle line to open into the dorsal vessel. They are surrounded by large clear peritoneal cells; in their course they receive numerous branches from the body-wall, some of these being in connection with the capillaries of the epithelium.

The origin of the commissural from the subneural vessel (figs. 1, 2, LAT.V., SUB.N.V.) is very difficult to observe, as in

Fig. 10.



Transverse section showing connection between branchial cavity and the cœlome. × 73.

C.COEL. = connection with cœlome. Other lettering as before.

most cases it was empty of blood, and, although the commissural vessel could be traced to the vicinity of the nerve-cord, the actual connection was only shown in a few cases.

(*f*) The Afferent Branchial Vessels (figs. 1, AF.B.V.) arise from the parietal branch (fig. 1, P.V.) of the ventral vessel of which they constitute the dorsal termination. The parietal vessels pass dorsalwards between the commissural vessels and the intestine; when dorsal to the gut they turn out and run towards the dorso-lateral margin, where, on reaching the longitudinal muscle-layer, they break up to form the afferent branchial vessels, which give rise to the vascular loops of the gills. The parietal vessel is covered by large clear peritoneal cells.

(*g*) The Efferent Branchial Vessels (fig. 1, EF.B.V.) occur segmentally and are formed by the fusion of the efferent limbs (figs. 1, 5, EF.C.) of the vascular loops of the branchial processes. Each vessel passes ventrally and towards the middle line, and ends by joining the commissural vessel (fig. 1, LAT.V.).

IV. The Course of the Circulation.

Bahl (1) has shown that in *Pheretima* the dorsal vessel, behind the first thirteen segments, is a channel only for collecting blood and propelling it forwards; this probably takes place in all earthworms. In *Pheretima* the disposition of the valves situated at the entrance of the dorso-intestinal and the commissural into the dorsal vessel support this view.

The ventral vessel is the chief distributing channel, while the subneural collects blood from the ventral part of the body-wall and the nerve-cord; the blood then passes into the commissural vessels, from which part goes to the intestine and the rest to the dorsal vessel. In *Lumbricus* the only source of blood for the intestine is the ventral vessel.

Interpreting the circulation of *Alma nilotica* on these lines, it is seen that the blood passes from the ventral vessel by its parietal branches into the afferent branchial vessels, and so to the gills. The blood returning from the branchiæ is collected into the efferent branchial vessel of the same side, which joins the commissural as this passes inwards to empty itself into the dorsal vessel.

The commissurals also receive blood from the body-wall, and the dorsal vessel receives blood from the intestinal plexus by the dorso-intestinal vessel.

V. Comparisons and Conclusions.

In *Dero* and *Aulophorus* the gills are outpushings of the body-wall, situated on the inner surface of the circumanal fossa; their cavity is cœlomic.

In *Branchiodrilus* the branchial processes are elongate hollow evaginations of the dorso-lateral body-wall in the anterior part of the animal which communicate with the cœlom, the muscular layers of the body-wall are apparently not prolonged into them.

In *Branchiura* the gills arise from the mid-dorsal and mid-ventral lines in the hinder body-segments. They are cylindrical processes containing a layer of muscle; the cavity, unlike that of *Alma*, is shut off from the cœlom.

The gills of *Hesperodrilus branchiatus* are on the posterior segments and resemble those of *Branchiura* in structure, but are dorso-lateral in position.

The gills of the branchiate Oligochæta thus differ widely among themselves in position, and in structure (whether all the layers of the body-wall are continued into them or not, whether the cavity is cœlomic or not).

The six genera belong to four different families; in some genera all the species are gilled, in others only one or two species. There can therefore be no question of a common origin or of a genetic relationship of the gilled forms. The gills of *Alma* could not have been derived from those of one of the other branchiate forms, or theirs from those of *Alma*.

In so far as the gills of the several forms resemble one another, the resemblances must be ascribed to convergence.

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XXXVI.—*The Godman-Thomas Expedition to Peru.*—V. *On Mammals collected by Mr. R. W. Hendee in the Province of San Martin, N. Peru, mostly at Yurac Yacu.* By OLDFIELD THOMAS.

AT a village named Yurac Yacu, about 20 miles W.N.W. of Moyobamba, Mr. Hendee was fortunate enough to find very good collecting-ground, so that his fifth consignment, the basis of the present paper, is by far the largest and most important of all—indeed, it is one of the finest collections we have ever received from Peru. No less than forty-eight species are contained in it, with good series of many groups of which we much needed further material, such as the monkeys, smaller opossums, and many others.

Accompanying the Yurac Yacu collection there are a few things from other localities, and among these occurred the remarkable new monkey, *Lagothrix* (*Oreonax*) *hendeei*, from Puca Tambo, of which a description has already been published, and also some specimens from San Nicolas, east of Chachapoyas.

It is to be noted that many of the mammals collected by M. Jean Stolzmann in 1880, which formed the basis of my earliest paper on Peruvian Mammals, the first since the time of Tschudi, were obtained in this very region, mostly at the now deserted Huambo, close to San Nicolas.

Mr. Hendee says of his collecting-places:—

"Yurac Yacu is a rather large village at the junction of the Yurac Yacu stream with the Rio Mayo. It is 35 miles east of Jumbilla on the opposite side of the mountains, and a little over 20 miles W.N.W. of Moyobamba.

"Owing to the exceeding richness of the soil, the land, once cultivated, can be used for years, and consequently little of the forest has been cut. For this reason it makes an especially good collecting-place. Deer, monkeys, and peccaries can be found within a few hundred yards of the houses. The altitude is about 2500′. The climate is noticeably cooler than that of Moyobamba, owing to the proximity of the mountains. Heavy forest occurs close round the village.

"I am glad to be here if only to see what it is to find animals really numerous, and I now understand what it is to collect in low subtropical country, and how it is that certain collectors have made such amazing collections. My second day here resulted in thirty specimens, and in a week I have ninety.

"San Nicolas is about 20 miles east of Chachapoyas. It lies in the old settled valley now called Huayabamba. The valley is obviously an old lake-bed, and is very swampy. The whole village has been under cultivation, and, though wooded, the trees merely represent a second-growth forest, known as 'purmas.' 'High forest' occurs all round, but is not easily reached from the village.

"Moyobamba lies in a special area, lightly forested—doubtless due to comparative soil-poverty. A narrow band of tropical forest runs between this area and the subtropical band at the side of the eastern range of mountains. In this band, which is really but a few miles in width, lies Yurac Yacu."

All specimens listed below are from Yurac Yacu unless otherwise stated.

1. *Alouatta seniculus*, L.

♂. 720, 721, 722, 726, 793; ♀. 794.

In these specimens the straw-coloured area on the back is comparatively small, and contrasts markedly with the darker colours elsewhere.

2. *Cebus azaræ pallidus*, Gray.

♂. 740; ♀. 716, 717.

A very provisional determination. These specimens have the light or rufous under surface of *pallidus* with the black tail of *C. fatuellus peruanus*.

3. *Lagothrix* (*Oreonax*) *hendeei*, Thos.

♂. 422 (type), 424 (young); ♀. 423. Puca Tambo, 5100′.

Although not part of the Yurac Yacu collection, further mention may be made here of the remarkable monkey from Puca Tambo described under the above name in this Journal *.

The type has since been remade, to match in make-up the Museum specimens of *Lagothrix*, and one now sees its characters to be even more striking than at first appeared. The long thick fur and grotesquely shortened hind limbs, thickly clothed to their digits, give it a quite peculiar

* Ann. & Mag. Nat. Hist. (9) xix. p. 156 (January 1927).

appearance, reminiscent of certain Old-World mountain-forms. Unfortunately no bones were left in the limbs, so that we shall have to wait for the arrival of a skeleton before a proper comparison can be made. The fur of the pectoral region and flanks is particularly long and soft, very different from the comparatively thin pelage of the corresponding parts in true *Lagothrix*.

The feet are very short and dumpy, much shorter than in similar-sized examples of *Lagothrix*, but whether this is at all due to shrinkage I cannot at present say. The ears are thickly clothed in fur, far more so than in *Lagothrix*.

The peculiar yellow lines running along each side of the prehensile part of the tail might give rise to a suspicion that this was Humboldt's "Choro" (*Simia flavicauda* *), never satisfactorily identified, but usually supposed to be a Howler. This suspicion is, however, soon dispelled by an examination of the rest of the description, for, apart from its yellow lines, the tail of the Choro is blackish olivaceous, not red as in *hendeei*, and the general colour of the animal is blackish brown instead of rufous posteriorly. The ears are naked, while those of *hendeei* are thickly hairy, and no mention is made of the white on the muzzle or of the short furry hind limbs.

But the yellowish lines on the tail are also occasionally found in true *Lagothrix*, and this may give a clue to the proper identification of *flavicauda*, for the other characters are, on the whole, similar to those of ordinary negro-monkeys, and it is therefore not improbable that *flavicauda* should be considered as a local *Lagothrix*, perhaps *L. lagotricha*.

"Shot in forest."—*R. W. H.*

4. *Callicebus œnanthe*, Thos.

♀. 700.

Essentially similar to Mr. Rutter's series of this striking and characteristic monkey from Moyobamba, but with longer and softer pelage, a difference no doubt seasonal. In consequence the whiteness of the face, hardly noticed in the original description, is here much more conspicuous, and contrasts with the general colour of the head and body.

* Recueil Zool. i. pp. 343 and 355 (1811).

5. *Saimiri sciurea petrina*, subsp. n.

♂. 729, 780, 786, 829; ♀. 730, 791.

No black cap; white head-markings unusually conspicuous.

General colour above buffy olivaceous, about as in *sciurea*, but less suffused with fulvous, the back not being so markedly more fulvous than the rest of the animal. Head with the crown uniformly clear grizzled olivaceous grey, without local blackening; white face and ear-markings large, conspicuous, far more developed than in any other race; the patches surrounding the eyes broad, clear white, very sharply defined, giving a general pierrot-like appearance to the animal; ear-patches equally conspicuous, strongly white instead of the usual dull whitish, the ears themselves thickly clothed with really white hairs, and the patches behind them very large, sharply defined, and conspicuous. Lips smoky, their hairs white. Throat and chest white, gradually becoming yellowish posteriorly and on the inner sides of the limbs. Yellowish of fore limbs rather more ochraceous than in *sciurea*, but scarcely extending on the average so far towards the elbows. Hind limbs to the ankles little paler than back, not bluish grey as in *madeiræ*; feet ochraceous. Tail with the terminal black tuft at a maximum.

Skull, as usual, variable in size and shape, but without special distinguishing characters.

Dimensions of the type:—

Head and body 330 mm.; tail 428; hind foot 90; ear 29.

Skull: greatest length 69; condylo-basal length 47; zygomatic breadth 42; breadth of brain-case 38·5; premolar-molar series 13·5.

Type. Adult male. B.M. no. 27. 1. 1. 14. Original number 829. Collected 23rd July, 1926.

"Shot in forest."—*R. W. H.*

This fine squirrel-monkey is readily recognizable by the unusual size and conspicuousness of the white head- and neck-markings, which stand out far more than in any other race.

Externally the series is very uniform in colour, and there is no trace of the occasional development of black head-markings, such as occurs occasionally in *sciurea*, and more often in the Ecuadorean race called *macrodon* by Elliot.

6. *Aotus miconax*, sp. n.

♂. 599, 601, 606, 608; ♀. 600, 602, 605, 607. San Nicolas, 4500′.

Face-markings not sharply defined; inner aspect of fore limbs grey.

Apparently most nearly allied to *A. senex*, Dollm., but the general colour above brownish fulvous instead of grey. Face-markings neither large nor very sharply defined, the black less in extent than in *nigriceps* and the light not strongly contrasted. Median black forehead mark of average extent, narrower than in *nigriceps*, broader than in *senex*; light supraorbital patches smaller and less sharply contrasted than in *senex*. Outer and median black markings terminating on the crown at about the same level between the ears.

Under surface, as usual, rich tawny, but this colour does not extend on to the inner aspect of the fore limbs, which are wholly grey; on the hind limbs it extends halfway down the tibiæ. In the other allied forms the tawny passes down to the wrists and ankles. Tail thicker and more bushy than in other species; its base below deep rufous, the rest black.

Skull without marked characteristics.

Dimensions of the type:—

Head and body 310 mm.; tail 330; hind foot 96; ear 32.

Skull: greatest length 62.

Hab. as above.

Type. Adult male. B.M. no. 27.1.1.17. Original number 599. Collected 25th May, 1926.

In the present complexity of the arrangement of the genus *Aotus* and the close relationship of all the known forms, I am somewhat loath to add a new species to the list; but the specimens of Mr. Hendee's excellent series differ so uniformly from the good series in the Museum of both *nigriceps* and *senex*, undoubtedly the nearest relations, that there appears to be no alternative. Probably many or all of these local forms will prove to be rather subspecies than species, but it seems best provisionally to give them binomial names, as it is at present impossible to say to which parent species their special names should be attached.

Young specimens are coloured quite like the adults.

"Shot in dense bushy forest."—*R. W. H.*

7. *Mystax devillei*, Geoff.

♂. 836, 837; ♀. 825, 838.

Rather darker across the mantle than specimens from the Lower Ucayali representing true *devillei*, but some Rutter examples from Moyobamba, therefore very near the present locality, cannot be distinguished from *devillei*. The colour of the feet of these marmosets and the extension of the grizzled body-coloration on to the tail prove more variable than was formerly supposed, and I now doubt if *apiculatus* and *mounseyi* ought to be separated from *devillei*. On the other hand, further examples from the Pachitea and Perené Rivers show that *pacator* may always be distinguished by its blackish mantle, almost or quite without red on the forearms.

8. *Myotis nigricans*, Wied.

♀. 589, 590. San Nicolas, 4500′.
♂. 613, 614, 615, 632; ♀. 634, 635, 636.
"Caught roosting in house." "Shot in street."—*R. W. H.*

9. *Molossus obscurus*, Geoff.

♂. 642; ♀. 639, 640, 641.

10. *Anthorhina peruana*, Thos.

♂. 760.

11. *Carollia perspicillata*, L.

♂. 588, 594; ♀. 584, 587, 596. San Nicolas, 4500′.
♂. 745, 797, 800, 802, 806, 807; ♀. 648, 744.
"Caught eating bananas in house."—*R. W. H.*

12. *Rhinophylla pumilio*, Pet.

♂. 828.

This bat is a very interesting capture, as it is exceedingly rare. Besides the topotypical specimen from Bahia catalogued by Dobson, two specimens collected by Bates at Ega were in the Tomes Collection, received in 1907, and Mr. Hendee's is now the fourth example to come to the Museum. There appears to be no tangible difference between the Peruvian and Bahian examples.

I may note that, as in *Carollia*, the zygomatic arch is unossified.

13. *Artibeus jamaicensis lituratus*, Licht.

♂. 765, 766, 835.

14. *Artibeus planirostris*, Spix.

♂. 779; ♀. 778.

15. *Uroderma bilobatum*, Spix.

♂. 646, 647, 817; ♀. 625, 626, 751.
♀. 759, 844 (in alcohol).

16. *Chiroderma villosum*, Pet.

♀. 643 (in alcohol).
Mr. Rutter also obtained two specimens of this rare bat at San Lorenzo, on the Marañon.

17. *Desmodus rotundus*, Geoff.

♀. 450, 451, 546, 548. San Nicolas, 4500′.

18. *Diphylla ecaudata*, Spix.

♂. 803, 842 (in alcohol).
"Roosting in house."—*R. W. H.*

19. *Felis pardalis*, L.

♂. 724.

20. *Nasua nasua mephisto*, subsp. n.

♂. 659, 660, 708.

Constantly black, with a suffusion of fulvous. Under surface also black; chin whitish; throat and inguinal region fulvous. Streak on side of neck strongly contrasted ochraceous, with a deep black patch above it. Face dark grey, with the usual lighter markings inconspicuously developed. Ears, hands, feet, and tail black.

Skull apparently as usual. Bullæ rather small.

Dimensions of the type:—

Head and body 560 mm.; tail 480; hind foot 94; ear 43.

Skull: condylo-basal length 118; zygomatic breadth 67; front of p^4 to back of m^2 20·5.

Hab. Peru. Type from Yurac Yacu, 2500′.

Type. Adult male. B.M. no. 27. 1. 1. 69. Original number 708. Collected 27th June, 1926.

In contrast with the irregular variability of the Nasuas of Brazil, those of the present region of Peru are so remarkably constant that they would seem to constitute a special local race. Specimens obtained by Mr. Rutter at Moyobamba and on the Pachitea, by Capt. Toppin on the Upper Madre de Dios, as well as those of the present series, are all of quite uniform coloration, while those from elsewhere are either of wholly different colour, or, if somewhat similar specimens occur, as they occasionally do in Matto Grosso, these are quite exceptional variations, and do not forbid one using a special local name for the black Peruvian animal.

Tschudi's *Nasua montana* is a decidedly smaller animal, of a more or less buffy or straw colour. Two specimens of it were obtained by P. O. Simons at Limbane, on the Inambari River, at 2200 m. The original locality—Umanpuquio, 8500′—I have been unable to identify.

Of other Nasuas, Tschudi's account is a lengthy mixture of various published notices of specimens from all parts of South America, and gives no further information about the black Peruvian form.

21. *Bassaricyon alleni*, Thos.

♂. 826.

22. *Tayra barbara peruana*, Tsch.

♂. 764; ♀. 736.

It is not easy to decide who is technically the author of the subspecific name *peruana*, whether Tschudi or Nehring, or neither, as both published it in a more or less invalid manner. But I provisionally accept Dr. Allen's decision that it may be credited to Tschudi, whose description in the 'Fauna Peruana' is its basis.

23. *Conepatus inca taxinus*, Thos.

♂. 195. Celendin.

24. *Sciurus pyrrhinus*, Thos.

♂. 658, 673; ♀. 653, 672, 694, 699, 707, 750, 755.

These specimens of *pyrrhinus*, which is placed by Dr. Allen in his "genus" *Mesosciurus*, present a striking resemblance

to *S. igniventris* and other members of his genus *Urosciurus*. But the differences between the generic groups of S. American squirrels are very intangible, and I should refer the majority of them to *Sciurus*.

25. *Nectomys apicalis*, Pet.

♂. 555, 603. San Nicolas, 4500′.

♂. 685, 710, 718, 723, 747, 763, 769, 787, 811; ♀. 667, 754, 762, 770, 812.

♀. 810 (in alcohol).

Rather a dark-coloured series, but mostly immature. The two oldest specimens attain 53 mm. in length of hind foot.

26. *Holochilus sciureus*, Wagn.

♂. 652, 715; ♀. 671, 756.

As is usual with river-haunting animals, local distinctions in *Holochilus* are few and unimportant, and I now see no sufficient reason for distinguishing the Peruvian Red Water-rat from that of the Lower Amazon.

27. *Oryzomys nitidus*, Thos.

♂. 695, 697, 713, 784; ♀. 702, 712, 757, 767, 822.

28. *Oryzomys longicaudatus destructor*, Tsch.

♂. 581, 609; ♀. 572. San Nicolas, 4500′.

♂. 621, 649, 761; ♀. 655, 661, 681, 814.

Tschudi's name *destructor*, with which his *melanostoma* is synonymous, would seem to be the proper term for the Peruvian mouse commonly called *minutus* or *stolzmanni*; but, as time goes on, and specimens from intermediate localities are obtained, I am inclined to believe that the Peruvian long-tailed mice are not specifically distinguishable from the *O. longicaudatus* of Chili, of which they may best be treated as a local subspecies.

29. *Œcomys osgoodi*, Thos.

♂. 684, 830; ♀. 743, 813, 818 (yg.).

Additional specimens are very welcome of this well-marked species, which was described from a specimen collected by Mr. Rutter at Moyobamba.

30. *Œcomys bicolor*, Tomes.

♂. 627, 665, 666, 678 ; ♀. 622, 624, 651, 662, 663, 664, 749.

Allowing for the discoloration of the type characteristic of specimens skinned out of spirit, these examples agree very closely with the specimen from Gualaquiza, Ecuador, described by Tomes. They are remarkably uniform *inter se*, the belly pure white in all.

So good a series forms a particularly welcome accession.

In the skull there is practically no projection forwards of the zygomatic plate, while in the larger species, such as *Œ. osgoodi*, there is a slight projection, though much less than in *Oryzomys*.

"Mostly caught in the house."—*R. W. H.*

31. *Akodon œrosus*, Thos.

♂. 619, 654, 656, 680, 693, 725, 727 ; ♀. 620, 676 (yg.), 690.

♀. 677, 741 (in alcohol).

32. *Akodon mollis*, Thos.

♂. 544, 560, 580 ; ♀. 545, 567, 578, and one in alcohol. San Nicolas, 4500′.

With regard to the difficult question of the Akodonts with projecting zygomatic plates and those with the plates slanting in front, and my reference of the latter to the genus *Microxus*, my colleague, Mr. Hinton, has been good enough to make for me an expert comparison of young molars of the two forms. He tells me that, so far as these North Peruvian animals are concerned, there is no difference at all between the two, and certainly the zygomatic plates tend to grade into each other. It would thus seem advisable, with Mr. Osgood, to call both of them members of *Akodon*, those with projecting plates being of the species *œrosus*, *surdus*, and *mollis*, and those with slanting plates *orophilus* and *torques*, the former with normally-shaped heads and large eyes, the latter with more slender muzzles and small eyes.

But, none the less, I consider the genus *Microxus*, as based on *mimus*, *bogotensis*, and *lanosus*, as possibly valid, the characters of the very narrow bar-like zygomatic plate much more marked and *Oxymycterus*-like than in *A. orophilus*, and the whole skull smooth, papery, with large brain-case and slender

upturned muzzle. No doubt there is a gradation, but whether it is complete enough to invalidate the genus is not yet clear. It is to be hoped that Mr. Hendee will drop upon the true *Microxus*, of which *M. mimus*, the genotype, was obtained by Mr. Simons at Limbane, on the Upper Inambari River, S.E. Peru. Young specimens will be particularly welcome.

33. *Mesomys ferrugineus*, Günth.

♂. 776; ♀. 748, 834.

From the intermediate altitude of 2500′ these specimens are more or less intermediate between *leniceps* and the other races of *ferrugineus* in the degree of spininess of the head. All are white-spotted above, as in *spicatus*.

"Shot in thorny palm-tree at edge of forest; said to be not uncommon."—*R. W. H.*

34. *Dasyprocta fuliginosa*, Wagl.

♀. 296, 299. Condechaca, Rio Utcubamba.

Obtained also by Rutter at Chachapoyas and on the Rio Pachitea.

35. *Sylvilagus defilippii*, Cornalia.

♂. 689, 795, 832; ♀. 704, 781, 827.

Following Mr. Osgood, I provisionally use Cornalia's early name for the rabbit of the Moyobamba region.

36. *Odocoileus peruvianus*, Gray.

♀. 343 (imm.). Tambo Ventilla, 8150′.

37. *Mazama americana*, Erxl.

♀. 758 (imm.).

38. *Tamandua tetradactyla quichua*, subsp. n.

♀. 790, 804, 841 (albino).

A Tamandua with rather long fur and of a wholly black colour, without lighter markings of any kind, except that on the middle of the tail, on the short-haired part, there are a few inconspicuous yellowish marblings.

Skull as in ordinary *tetradactyla*.

Dimensions of the type:—

Head and body 590 mm.; tail 543; hind foot 97; ear 46.

Skull: occipito-nasal length 130; breadth across brain-case 44; nasals, length 45, breadth at centre 5·5.

Hab. Northern Peru. Type from Yurac Yacu, 2500′.

Type. B.M. no. 27. 1. 1. 156. Original number 804. Collected 20th July, 1926.

Just as in the Coatis there is a great tendency to blackening in this region of Peru, so here, with the Tamanduas, all the available specimens, from Yurac Yacu, Chanchamayo, and Pozuzo, are wholly black (apart from one single complete albino), while in other localities black specimens are almost entirely unknown, or, if they occur, are in a very minute minority. To emphasize this peculiarity of distribution a local subspecific name might be given to the North Peruvian race.

The name *Myrmecophaga nigra*, of Geoffroy, quoted by Desmarest, does not seem to be available for it, since, when first described *, *nigra* was distinctly said to be from Guiana, while its later and better-known account † was largely based on a figure by Azara, so that neither reference could be assigned to a Peruvian animal. No doubt, both were founded on exceptional melanoid examples of the ordinary Tamandua.

39. *Tatu novemcinctus*, L.

♀. 805.

40. *Didelphis marsupialis etensis*, All.

♂. 155. Pacasmayo.
♀. 565. San Nicolas, 4500′.

41. *Didelphis paraguayensis pernigra*, All.

♂. 185, 186. Celendin.

42. *Metachirus opossum canus*, Osg.

♀. 610. Rioja, San Martin, 2500′.
♀. 612. Moyobamba, 2500′.
♂. 629, 669, 670, 688, 706, 798; ♀. 735, 773. Yurac Yacu, 2500′.

The specimen from Moyobamba is a topotype, as is one previously obtained by Mr. Rutter.

* Desm. N. Dict. d'Hist. Nat. (1) xxiv. Tabl. p. 27 (1804).
† *Id. op. cit.* (2) xii. p. 107 (1817).

43. *Metachirus nudicaudatus tschudii*, All.

♂. 558, 585; ♀. 591, 592, 593. San Nicolas, 4500′.
♂. 705, 733, 824; ♀. 687, 771. Yurac Yacu, 2500′.

Practically topotypical, Allen's *M. tschudii* having been described from "Guayabamba" (=Santa Rosa de Huayabamba, just south of San Nicolas), alt. 5500′.

44. *Philander laniger ornatus*, Tsch.

♂. 737; ♀. 831.
"Caught in nest in cave."—*R. W. H.*

45. *Marmosa germana*, Thos.

♂. 809, 821; ♀. 789, 790.

Closely agree with the typical specimen from Sarayacu, E. Ecuador. The Ucayali *M. rutteri* is nearly allied, but has much more buffy under surface and inner side of hips.

Mr. Rutter obtained an example of this species at San Antonio, Lamas, S.E. of Moyobamba, in 1923.

46. *Marmosa noctivaga lugenda*, subsp. n.

♂. 728. Yurac Yacu. B.M. no. 27. 1. 1. 178. Collected 2nd July, 1926. *Type.*

Very like *M. madescens* in colour, but with the skull-characters of *M. noctivaga.*

Size as in *noctivaga.* General colour above very dark brown, as dark as or even darker than *M. madescens*, and with scarcely a trace of rufous. Under surface broadly white, the whole breadth of the throat, chest, and inguinal region white to the roots of the hairs, and even on the belly the white is but little narrowed, fully 15 mm. in breadth, and not very sharply defined laterally. Face-markings black and strongly contrasted. Hands and feet brown, the digits whitish. Tail brown, the terminal half of its under surface whitish.

Skull as in *noctivaga*—long, narrow, with clearly-defined narrow supraorbital beading.

Dimensions of the type:—

Head and body 135 mm.; tail 180; hind foot 20·5; ear 21.

Skull: greatest length 37·7; condylo-basal length 36·5; zygomatic breadth 18·6; nasals 17·5 × 4·3; interorbital breadth 7; length of ms^{1-3} 6·5.

This is a darkened race of *M. noctivaga*, corresponding in

that respect to the darkened races of *Nasua* and *Tamandua* already referred to. Found with the very similar *M. madescens*, one might have been tempted to think the type was simply a very old specimen of that animal with supraorbital ridges developed in old age; but, firstly, it is not very old, certainly not nearly so old as no. 686, which is quite without ridges; secondly, the size of the teeth is greater; and, thirdly, the colour, although like, is not identical with that of *madescens*, the under surface being more broadly white. From true *noctivaga*, as represented by specimens from Chanchamayo, it is at once distinguished by its deep brown colour.

47. *Marmosa musicola*, Osg.

♂. 628, 738, 785, 839; ♀. 772, 808, 823, 833.

These little opossums clearly represent Osgood's *M. musicola* from Moyobamba, and illustrate well the variation that must be allowed for in working at this most difficult genus. All have brown tails with but little or no indication of yellow marbling, while in the type of *M. quichua* the terminal half of the tail is white.

But of the skulls only nos. 772 and 823 have the distinct angular postorbital processes described in the type, the others having more narrow rims of various development, some of them exactly matching the type of *M. quichua*. This is no doubt a question of age. And even in the tail-coloration such few specimens as we have of *quichua* are not constant, so that when further material is obtained I think *musicola* will prove to be at most subspecifically distinct.

I may note that the very distinct *M. lepida* of the Huallaga, described by me in 1888, has again turned up at Buenavista, Bolivia, whence a specimen has been recently sent by Señor Steinbach.

With regard to Tomes's *Didelphys waterhousei*, whose taxonomic history has been full of confusion and error *, I regret to find that in describing *Marmosa maranii* I have added another mistake to the list; for the typical skull of the latter proves to match in every detail that of *waterhousei*, the only part of the type now existing, and the skin agrees sufficiently well with Tomes's description. Gualaquiza, Ecuador, whence came *waterhousei*, is on the same river-system as the Marañon, the connecting Santiago River joining the latter not very far above where *maranii* was captured.

This discovery enables us to know the general characters

* *Cf.* Ann. & Mag. Nat. Hist. (9) vii. p. 522 (1921).

of *M. waterhousei*, which had hitherto been in great doubt, and is therefore a step towards the clearing up of this most difficult genus, to whose study Mr. Hendee's beautiful series forms a valuable contribution.

48. *Marmosa madescens*, Osg.

♂. 563, 575; ♀. 561. San Nicolas, Amazonas, 4500′.

♂. 657, 674, 686, 711, 719, 739, 753, 774, 775, 777, 788, 840; ♀. 668.

♂. 820; ♀. 691, 796 (in alcohol).

Only previously obtained for us by Mr. Rutter.

The oldest specimens do not attain the size of *M. sobrina*, otherwise so similar; nor have they any trace of supraorbital beads, such as occur in *M. noctivaga*.

One of the females shows 3—1—3=7 mammæ only, but there is no evidence as to whether this is the usual number.

XXXVII.—*On new or little-known* Notonectidæ (*Hemiptera-Heteroptera*). By G. E. Hutchinson, Department of Zoology, University of the Witwatersrand, Johannesburg.

1. *Notonecta maculata*, var. *fulva*, Fuente.

Individuals of this species with clear brown elytra are said by Delcourt (Bull. Sc. Fr. Belg. xliii. ser. 7, i. p. 373 *et seq.*, 1909) to be found sporadically in Italy, Spain, and N. Africa, and to be the only form of the species occurring in Portugal. Fuente (J. M. de la Fuente, Act. Soc. Esp. Hist. Nat. 1897, p. 129, in Ann. Soc. Esp. Nat. Hist. xxvi. 1897) has described as *N. glauca*, var. *fulva*, a form—"elytra fulva, sine maculis, una tantum levissima excepta in basi suturæ locata"—from Pozuelo de Calatrava, Spain, which agrees essentially with these immaculate specimens of *N. maculata*, F., and with no form of *N. glauca*, L., known to me. The exact position of the faint spotting or clouding of black which may remain is variable, but the form is characteristic, and there seems no reason why the varietal name *fulva* should not be used. *N. maculata*, though a very distinct species, was, of course, not recognized as such when Fuente wrote, so that he would naturally refer his new variety to *N. glauca*.

2. *Notonecta viridis meridionalis*, subsp. n.

Distinguished from *N. v. viridis*, Delc., by black mottling on the membrane and the apical half as well as the outer

border of the corium, both the distal angles of the corium being black and the marking extending more or less on to the disc. The distal part of the corium and the base of the membrane tend to be reddish between the mottling.

Type. Astroni, near Naples, Italy, 19. iv. 1926.

Specimens examined from Italy (Naples, *G. E. H.*; Taranto, B.M.); Greece (Parnassus, B.M.; Naxos, B.M.); Cyprus (coll. *G. E. H.*); Crimea (Sebastopol, coll. *G. E. H.*); N.W. Persia (Deir, B.M.; Daulatabad, Seistan, B.M.); Buchara (Kerki, coll. *G. E. H.*, two specimens approaching *v. viridis*).

The mottled appearance of Mediterranean specimens of this species was noted by Delcourt (*l. c.*). It seems sufficiently constant to justify a new subspecific name, as the form is of considerable evolutionary interest. Parenthetically it must be remarked that *viridis*, Delc. (=*halophila*, Edw., *vide* Poisson, Bull. Soc. Ent. Fr. 1925), is a perfectly distinct species, distinguished not merely by size, colour, and ♂ genitalia, but also by the acute anterior angles of the pronotum—a character that Mr. E. A. Butler once told me he noticed in the net when collecting the types of *halophila.*

The Cypriote specimens above mentioned are the darkest that I have seen from known localities, resembling in elytral pattern the most mottled form of *N. glauca*, L., taken in England. The elytra are well marked over the disc, leaving quite definite pale proximal stripes in the same position as those of *N. furcata*, F. There are, moreover, two specimens in the British Museum, most unfortunately without locality-labels, in which the elytra have become almost entirely black except for the two yellow stripes. Very little further darkening would produce a form of *N. viridis* completely analogous to *N. furcata.*

I should be most grateful for specimens of or information about these very interesting insects, and hope that entomologists travelling in the Near East will keep a sharp look-out for them.

3. *Anisops aldabrana*, Dist. (Fig. 1.)

Anisops aldabrana, Distant, 1913, Rhynchota, pt. i., Rep. Percy Sladen Trust Exp. to Indian Ocean, v., being Tr. Linn. Soc., Zool. (ii.) vol. xvi. p. 189.

This species was described from a number of specimens collected by Fryer on Aldabra Island in 1908. Distant's diagnosis is quite inadequate, being confined to colour, size, and the vaguest indication of general structural characters. Through the kindness of Dr. H. Scott, of the Cambridge

University Museum of Zoology, I now possess a male specimen of this species from Fryer's original series, and can add the following details to the meagre original description :—

Fusiform, widest across the posterior region of the pronotum, tapering posteriorly; pronotum about one-tenth wider than the head and eyes. Vertex just under one-seventh the width of the head and eyes and three times as wide as the synthlipsis.

Facial tubercle (♂) with a flattened depression which is slightly carinate laterally, notocephalon slightly longitudinally foveate between two very faint longitudinal carinæ.

Pronotum a little more than twice as wide as long.

Anterior tibia (♂) with a large stridulatory comb on a ridge-like eminence, about once and a half as long as the monomerous tarsus, which is three times as long as the longer claw (fig. 1, *a* and *b*).

Fig. 1.

Anisops aldabrana, Dist., ♂.

a, left anterior tibia; *b*, right anterior tarsus and claw.

Intermediate tibia almost twice as long as the first tarsal joint, which is rather less than twice as long as the second, claw five-eighths as long as the latter (27 : 14 : 8 : 5).

Length 4·6 mm.

Distant (*l. c.*) figures a female specimen, which is shown as a subparallel rather than a fusiform insect.

4. *Anisops genji*, sp. n. (Fig. 2.)

? *Anisops scutellaris*, Uhler, 1896, Pr. U.S. Nat. Mus. xix. p. 275.
Nec *Anisops scutellaris*, H.-S., 1850, Wanz. Ins. ix. p. 40.
Nec *Anisops scutellaris*, de Carlini, 1892, Ann. Mus. Genova, xxxii. p. 537.

In his revision of the genus Kirkaldy (1904, Wien. Ent. Zeit. xxiii. p. 119) stated that he was unacquainted with *A. scutellaris*, Uhler, but believed it to be a species distinct from *A. nivea*, F. (=*A. scutellaris*, de Carl., and ? *A. scutellaris*, H.-S., *fide* Kirkaldy). I have had in my collection for several years four specimens of a species of *Anisops*

received from Messrs. Staudinger and Bang-Haas as *A. scutellaris*, which confirm Kirkaldy's suspicion that an unrecognized form exists in Japan.

Notocephalon yellowish; pronotum pale yellowish grey; scutellum blackish, with a wide orange border along the posterior margin, wider in the ♀ than in the ♂; abdomen blackish. Subparallel, widest at the first fifth or quarter of the elytra, *i. e.*, before the middle of the insect; pronotum about one-sixth wider than the head and eyes. Head and eyes about four and one-third times as wide as the vertex, which is three times as wide as the synthlipsis. Anterior part of the notocephalon with a very slight fovea between two longitudinal carinæ which converge anteriorly.

Pronotum a little less than twice as wide as long.

Scutellum from about one and a fifth times to nearly twice as long as the pronotum.

Fig. 2.

Anisops genji, sp. n., ♂. Left anterior leg.

♂. Facial tubercle well developed, but rather flat, widely excavated below, the sides of the tubercle carinate and within them two subsidiary carinæ. The lateral carinæ converge in front and are continuous with the median carina formed by the convergence of those on the vertex.

Anterior tibia with a small stridulatory comb, about half as long again as the tarsus, which is from rather more than two to rather more than three times as long as the longer claw (fig. 2).

Intermediate tibia twice, or a little less, as long as the first tarsal joint, which is once and a half to about twice as long as the second, longer claw rather more than half as long as the latter.

♀. Slightly larger and more robust, with a proportionately shorter head. Facial tubercle obsolete.

Anterior leg with tibia nearly twice and a third as long as

the first tarsal joint, which is once and two-thirds as long as the second, longer claw two-thirds as long as the latter.

Intermediate leg with tibia nearly twice as long as the first tarsal joint, which is just over twice as long as the second, longer claw half as long as the latter.

Length, ♂ 7·0, ♀ 7·2 mm.

Type (♂) and three paratypes (♂ ♂ and ♀), "Japan" (coll. *G. E. H.*).

The types of the two new forms described in this paper will be forwarded to the British Museum.

XXXVIII.—*A new Blind Snake from Madagascar.* By H. W. Parker, B.A.

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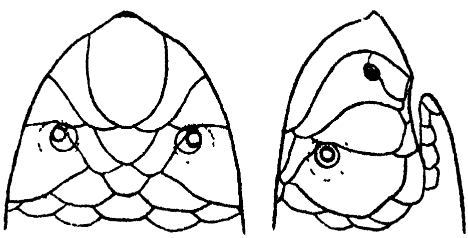
Amongst a collection of reptiles and batrachians from Madagascar which has recently been acquired by the British Museum are five specimens of an apparently new species of the genus *Typhlops*. The author wishes to acknowledge his indebtedness to M. F. Angel, of the Muséum National d'Histoire Naturelle, Paris, who has very kindly compared several figures with some of the type-specimens which are under his charge.



Typhlops ocularis, sp. n.

Typhlops ocularis, sp. n.

Type-specimen a ♀, number 1926. 8. 18. 3 in the British Museum, from the Antongil Forest, Maroantsetra, N.E. Madagascar.

Snout very prominent; nostrils inferior. Rostral large, with sharp horizontal edge, its upper portion about two-fifths

the width of the head, longer than broad and extending posteriorly to the level of the eyes; the portion visible from below as long as broad; nasal completely divided, the cleft proceeding from the second labial, separated from its fellow on the upper surface of the head; præocular present, distinctly smaller than the nasal or the ocular, in contact with the second and third labials; eyes distinct, relatively large, below the ocular, but encroaching on the præocular and supraocular, causing a slight protuberance externally; præfrontal and supraoculars slightly enlarged; four upper labials. Diameter of body contained fifty-seven times in the total length; tail once and a half as long as broad, ending in a strong spine. Twenty scales round the body.

Colour in spirit.—Uniform pale brownish grey above, somewhat lighter beneath.

Total length 342 mm.; tail 8 mm.

The four paratypes from the type-locality exhibit no important variations. The ratio of diameter to length may be as low as $\frac{1}{64}$, and the tip and under surface of the tail are frequently white.

This new species is very closely allied to *T. arenarius*, Grandidier, but is distinguished by the rather larger eyes, longer rostral, smaller præoculars, enlarged præfrontal and supraoculars, and the longer tail.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

December 1st, 1926.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

The following communication was read:—

'On Lower Old Red Sandstone Plants showing Structure, from Brecon (South Wales).' By Dr. Albert Heard, M.Sc., F.G.S.

A new fossil plant-locality is recorded from the Senni Beds, in the neighbourhood of Brecon. Several genera of a Lower Old Red Sandstone flora have been obtained from this occurrence.

A new method of ascertaining details of the internal morphology of pyritized plant-specimens is described.

A new Lower Old Red Sandstone plant, *Gosslingia breconensis*, is recorded; the plant is rootless and leafless, with stomata and hairs. Gregarious, erect, dichotomously-branched, cylindrical stems arise from dichotomously-branched rhizomes with rhizoids; branches exhibiting equal dichotomy are subordinate to a thicker

sympodial main axis, which shows an unequal dichotomy; the stems are circinately coiled in the apical regions.

The stele consists of a large strand of tracheids which have both spiral and reticulate thickening, surrounded by protoxylem and phloem; the outer cortex of the aërial stem consists of four layers of thick-walled cells. Reniform appendages borne on special branches, which emerge from immediately below the bifurcation of the stems on the sympodial main axis, are interpreted as sporangia.

A peculiar organism resembling *Pachytheca* is described.

December 15th, 1926.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

The following communications were read:—

1. 'A Revision of the Non-Marine Lamellibranchs of the Coal-Measures, and a Discussion of their Zonal Sequence.' By John Henry Davies, F.G.S., and Arthur Elijah Trueman, D.Sc., F.G.S.

The paper deals with the Coal-Measure Lamellibranchs of the genera *Carbonicola*, *Anthracomya*, and *Naiadites*. As a result of the work of the late Dr. Wheelton Hind and others, the general sequence of the shells is known in Staffordshire and in certain other coalfields, but comparatively little attention has been paid to them in this country for some years.

The shells are remarkable for the breadth of variation at each horizon. Statistical studies of these variations are included in the paper, and it is shown that at many horizons the shells constitute a homogeneous community. The problems of nomenclature in such series are discussed, and the importance of statistical analyses of the variations is recognized.

Various restrictions in the current use of specific names are suggested, and some new species are described. As a result of these changes in nomenclature, certain common species are considered to have a shorter range than was formerly thought to be the case.

A description of the sequence in South Wales is given; the following zones are recognized:—

(6) Zone of *Anthracomya* sp. nov.
(5) Zone of *Anthracomya phillipsii*.
(4) Zone of *Anthracomya pulchra*.
(3) Zone of *Carbonicola similis*.
(2) Zone of *Anthracomya modiolaris*.
(1) Zone of *Carbonicola ovalis*.

In the Zones 1 to 4 *Carbonicola* and *Naiadites* are common, with at least two series of *Anthracomya* in Zones 2 & 4 respectively; in these four zones marine bands occur at intervals. In Zones 5 & 6 *Carbonicola* and *Naiadites* are practically unknown, mollusca being represented by a limited number of species resembling *A. phillipsii*; marine fossils are extremely rare above Zone 4.

Prof. P. Pruvost has studied these shells in the North of France, and, from an examination of his specimens, it is concluded that the succession in the North of France is closely comparable with that in South Wales. The relative abundance of the various genera is different, possibly indicating somewhat different conditions of deposition; but the general changes in the fauna make it possible to distinguish the zones.

The sequence in North Staffordshire, determined mainly from a study of the Wheelton Hind Collection, is also discussed. It is concluded that the Lamellibranchs afford a reliable basis for the correlation of the Coal Measures, and especially of that part of the Coal Measures which contains the more important seams.

2. 'The Ranikot Beds of Thal (North-West Frontier Provinces of India).' By Major L. Merson Davies, R.A., F.G.S.

The Author, a military officer who has been stationed on the north-west frontier of India for the last 22 years, and has been making a special study of the Eocene rocks of the Kohat district for the last 6 years, describes his discovery at Thal (70° 33′ long. E., 33° 32′ lat. N.) on the Afghan frontier, about 60 miles west of Kohat, of Ranikot Beds identifiable with those of Sind. The interest of the discovery lies in the fact that Ranikot Beds have never before been known to exist, in India, outside a very limited area in Sind; and the new exposures are more than 500 miles north of any hitherto known of the kind. Many new species, mostly corals, are found in the Thal beds, and the greater number of these still remain to be worked out; but the following eight species, of molluscs and corals, have been identified with Ranikot forms from Sind:—*Ampullina (Crommium) pervicina* Cossmann & Pissarro; *Semicassis phillipsi* A. d'Archiac & J. Haime; *Turritella diastropha* C. & P.; *Mesalia mecquenemi* C. & P.; *Astrocœnia blanfordi* Duncan; *Isastræa punctata* Duncan; *Diploria flexuosissima* A. d'Archiac; *Astrocœnia cellulata* Duncan.

The Author then makes a more particular examination of the foraminifera of the Thal beds. He does not accept the identity of the Indian species hitherto referred to *Nummulites planulatus* (Lamarck), since the former is a granulated form, and more primitive in several respects. He redescribes it under another specific name, and points out its close affinity to the form hitherto referred to *O. canalifera* A. d'Archiac. The latter is also redescribed under another specific name, and compared with certain forms from the Lower Eocene of Europe and Egypt. A. d'Archiac & Haime's type *Dictyoconoides* [*Rotalia*] *newboldi* has been rediscovered at Thal; and proves, as those authors suspected, to consist of two species. Dr. W. L. F. Nuttall's *Discocyclina* sp. of Sind appears in considerable numbers at Thal, and is described under a new specific name; while the megalospheric companion of

the redescribed *N. planulatus* and the microspheric companion of *Siderolites miscella* are also found at Thal and described under new specific names. A variety of *Nummulites globulus* Leymerie is found at Thal, and described as new. The lowest Ranikot Beds at Thal contain a new species, which is not far removed from *N. lucasi* (Defrance).

The following Thal foraminifera are specifically identified with forms from the Ranikot Beds of Sind: *Nummulites* sp. nov.; *Assilina ranikoti* Nuttall; *Operculina* sp. nov.; *Siderolites miscella* A. d'Archiac & Haime; *Dictyoconoides conditi* Nuttall; *D.* sp. nov.; *Discocyclina* sp. nov.; and *Alveolina oblonga* A. d'Orbigny. The following are probably also identifiable, since they were reported by A. d'Archiac & J. Haime from the 'yellow limestone of the Hala Range' in Sind:—*Operculina* cf. *canalifera* A. d'Archiac; and *Dictyoconoides newboldi* (A. d'Archiac & J. Haime).

The Author discusses the age of the Ranikot Series, and agrees with Dr. Nuttall that it is certainly pre-Ypresian. He inclines to correlate the Upper Ranikot with the Middle Landenian of Europe, and the Lower Ranikot with the Lowest Landenian and Montian.

MISCELLANEOUS.

International Commission on Zoological Nomenclature.

The Secretary of the International Commission on Zoological Nomenclature has the honour to announce the publication of Opinions 91 to 97 (rendered by the International Commission on Zoological Nomenclature) by the Smithsonian Institution in 'Smithsonian Miscellaneous Collections,' vol. lxxiii. no. 4, pp. 1–30. The summaries read as follows:—

Opinion 91. Thirty-five Generic Names of Mammals placed in the Official List of Generic Names.—The following names are hereby placed in the Official List of Names:—*Alces*, *Arvicola*, *Ateles*, *Bison*, *Bradypus*, *Canis*, *Capra*, *Cebus*, *Cervus*, *Cholœpus*, *Condylura*, *Cricetus*, *Crocidura*, *Cystophora*, *Dasyprocta*, *Didelphis*, *Erethizon*, *Felis*, *Gulo*, *Halichœrus*, *Lepus*, *Lynx*, *Mus*, *Myrmecophaga*, *Nasua*, *Ovibos*, *Phyllostomus*, *Procyon*, *Putorius*, *Rangifer*, *Rhinolophus*, *Rupicapra*, *Sciurus*, *Sorex*, *Vespertilio*.

Opinion 92. Sixteen Generic Names of Pisces, Amphibia, and Reptilia placed in the Official List of Generic Names.—The following names are hereby placed in the Official List of Generic Names:—Pisces: *Blennius*, *Echeneis*, *Esox*, *Ophidion*. Amphibia: *Cryptobranchus*, *Desmognathus*, *Siren*. Reptilia: *Alligator*, *Calamaria*, *Chelydra*, *Crotalus*, *Dermochelys*, *Eremias*, *Lacerta*, *Mabuya*, *Phrynosoma*.

Opinion 93. Twelve Generic Names of Fishes placed in the Official List, by Suspension of the Rules.—The following twelve generic names of fishes are herewith placed in the Official List of Generic Names, under the Plenary Power for Suspension of the Rules:—*Conger*, Cuv., 1817 (*Muræna conger*, L.): *Coregonus*, Linn., 1758 (*Salmo lavaretus*, L.); *Electris*, Bloch & Schneider, 1801 (*gyrinus*, Cuv. & Val.); *Epinephelus*, Bloch, 1792 (*marginalis*, Bloch); *Gymnothorax*, Bloch, 1795 (*reticularis*, Bloch); *Malapterurus*, Lacépède, 1803 (*Silurus electricus*, L.); *Mustelus*, Linck, 1790 (*Squalus mustelus*, L. [= *Mustelus lævis*]); *Polynemus*, Linn., 1758 (*paradisæus*, L.); *Sciæna*, Linn., 1758 (*umbra*, L. = *Cheilodipterus aquila*, Lacép., as restr. by Cuvier, 1815); *Serranus*, Cuv. (*Perca cabrilla*, L.); *Stolephorus*, Lacép., 1803 (*commersonianus*, Lacép.); *Teuthis*, Linn., 1766 (*javus*, L.).

Names now current are not to be discarded unless the reasons for change show a clear-cut necessity.

Opinion 94. Twenty-two Mollusk and Tunicate Names placed in the Official List of Generic Names.—The following names are hereby placed in the Official List of Generic Names:—Mollusca: *Anodonta*, *Argonauta*, *Buccinum*, *Calyptræa*, *Columbella*, *Dentalium*, *Helix*, *Limax*, *Mactra*, *Mya*, *Mytilus*, *Ostrea*, *Physa*, *Sepia*, *Sphærium*, *Succinea*, *Teredo*. Tunicata: *Botryllus*, *Clavelina*, *Diazona*, *Distaplia*, *Molgula*.

Opinion 95. Two Generic Names of Protozoa placed in the Official List of Generic Names.—The following names are hereby placed in the Official List of Generic Names:—Protozoa: *Endamœba*, *Trypanosoma*.

Opinion 96. 'Museum Boltenianum.' The Commission accepts the 'Museum Boltenianum,' 1798, as nomenclatorially available under the International Rules.

Opinion 97. Did Hübner's 'Tentamen,' 1806, create monotypic genera? Hübner's 'Tentamen,' 1806, was obviously prepared essentially as a manifolded manuscript, or as a proof-sheet (*cf.* Opinion 87), for examination and opinion by a restricted group of experts—*i. e.*, in Lepidoptera,—and not for general distribution as a record in zoology. Accordingly, the conclusion that it was published in 1806 is subject to debate. Even if the premise be admitted that it was published in 1806, the point is debatable whether the contained binomials should be construed as generic plus specific names. Even if it be admitted that the binomials represent combinations of generic plus specific names, they are essentially *nomina nuda* (as of the date in question), since authors who do not possess esoteric information in regard to them are unable definitely to interpret them without reference to later literature. If published with more definite data at later dates, these names have their status in regard to availability as of their date of such republication. C. W. Stiles, *Secretary*.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 112. APRIL 1927.

XXXIX.—*The Carboniferous Insects of Maryland.*

By T. D. A. COCKERELL, University of Colorado.

[Plates V.-VII.]

ALTHOUGH the Coal Measures cover only a comparatively small area in Maryland, they have yielded, thanks mainly to the keen sight of Mr. H. Bassler, a remarkable series of fossil insects. In the present report I have dealt only with those which were well-preserved, or which, though fragmentary, were sufficiently characteristic to add definitely to our knowledge. Very many fragments, almost entirely of cockroaches, have been set aside awaiting better material. A few species in the collection come from adjacent States: Pennsylvania and West Virginia. The whole collection is the property of the Maryland Geological Survey.

It seems probable that the insects may prove exceedingly important for stratigraphy. Observations on Tertiary and Quaternary insects indicate that they evolve or change more rapidly than plants, but less rapidly than mammals. Their mobility makes migrations possible; and in Palæozoic times, when minute adaptations to special conditions (*e.g.*, food-plants) probably were not the obstacle to successful migration that they are to-day, it may have been that migrations produced more rapid and frequent changes in faunæ than they do now. In the modern fauna altitude is of prime importance, so that, as for instance between Vera Cruz and the City of Mexico, extremely different faunæ may co-exist not far apart. It is natural to enquire whether the Mazon Creek fossils, for example, represent a typically lowland environment; while the numerous localities in Pennsylvania, which

produce smaller insects, Blattoids alone, represent approximately contemporaneous upland conditions. Such a supposition can, I think, scarcely be entertained, as presumably all the coal-beds represent essentially lowland conditions—certainly conditions of warmth and moisture, with luxuriant vegetation.

In dealing with changes in insect-faunæ due to migrations, some caution is necessary. Under modern conditions in Colorado, for example, the influence of man is such that every few years, perhaps every year, some new insect enters the State and becomes common. Thus, if we had good collections made at intervals of ten years, it might be possible by mere inspection, given the requisite knowledge, to place the lots in their chronological order. Undisturbed nature would not exhibit such rapid changes, but fossil-beds in which some conspicuous genus occurred might be separated by only a few years from those in which it was totally absent. It would thus be possible to obtain an exaggerated idea of the remoteness of two or more deposits; but, on the other hand, such data, properly estimated, would give us very exact and valuable guides for stratigraphical correlation.

There is one other consideration which suggests the superiority of insects over plants for stratigraphy. In dealing with Tertiary insects we find the details of wing-structure sufficiently stereotyped to enable us to place generically even parts of wings. Plants might afford equally valuable characters if we had the necessary parts, but usually we have only the vegetative, and least characteristic, portions. In the Palæozoic the insects were by no means so true to details of structure, and, in fact, their modern representatives among the Orthoptera show very great variation; but, on the whole, there can be little doubt that the parts of insects available for study usually show the generic and specific characters better than the preserved parts of plants. On the other hand, at present the number of available insects is rather small, and especially the number of localities represented is less than we could wish. At the present time, the following successive periods, beginning with the most ancient, can be distinguished in this country by the insect fossils.

(1) *Age of Palæodictyoptera.*

During this period the most ancient insects known, the Palæodictyoptera, reached a high degree of development, becoming greatly diversified, and some of them quite large. There were no Blattoids, no Protorthoptera or Protoblattoids. The famous locality is St. John, New Brunswick. Other localities mostly have produced so few species that we cannot be confident that the Blattoids were absent; near Altamont Colliery, Pa.; Gibson Fork and Drews Creek, W. Va.; Cranston, R.I.; Braxton Quarry, Ind.; Pratt Mines, Cordova and Coalburg, Ala. Mr. G. F. Matthew, who collected for years at St. John, writes me that he never found the least trace of a Blattid. He was constantly on the look-out for them, because the fronds (pinnæ) of *Neuropteris* simulate

their wings so nearly. The accompanying plants he considers to show Devonian affinities, but David White and Kidston considered them Carboniferous. We can at least say that the age of Palæodictyoptera, prior to the appearance of Blattoids, was Pottsville or older. The discovery of a deposit of Mississippian insects would, of course, throw a flood of light on this subject.

(2) *Dawn of Blattoids.*

Archimylacridæ present, but no Mylacridæ or Protoblattoids. This appears to be a recognisable division equivalent to the Upper Pottsville, but it is as yet imperfectly known. It may not prove valid.

(3) *Mazon Creek Age.*

Represented by the remarkable nodules at Mazon Creek, Ills. Palæodictyoptera abundant, some of them of very large size. Protodonata (ancestors of dragon-flies) present. Very numerous Protorthoptera (including Protoblattoids). Many Blattoids, some very large; Archimylacridæ and Mylacridæ both represented. The subfamily Palæoblattinæ of Archimylacridæ present. The corresponding fauna in Europe is that of Commentry. The present indications, so far as the insects go, place Mazon Creek at the very base of the Allegheny, which is older than the current interpretation. Commentry is supposed to be much later, and its fauna has little or no resemblance to ours of supposedly equivalent age. It appears nearly certain, or at least highly probable, that the Blattoids originated in America, and it is at least likely that their rise had something to do with the disappearance of the Palæodictyoptera. If the Palæodictyoptera were crowded to the wall by the very successful and numerous Blattoids, this may well have occurred later in Europe than in America; and hence Commentry, with its gigantic Palæodictyopterans, may be much later than Mazon Creek. An objection to this theory is found in the fact that the Archimylacrids reached Europe, including forms very like those of Mazon Creek; but the typical Mylacrids did not, and apparently none whatever existed at Commentry. Hence we should suppose that Europe received its Blattoids very early, probably during the Upper Pottsville. It is to be noted that Mazon Creek has a large and varied Amphibian fauna, but no reptiles, whereas reptiles occur at Commentry.

The other localities which seem to be of Mazon Creek age are Campbell's Ledge, Pa., E. Providence, R.I., and Cape Breton. The coal mine, "150 ft. deep, Braceville, Grundy Co., Ills.," is, I am informed by Mr. L. E. Daniels, about 7 or 8 miles S.E. of the Mazon Creek upper bed; he thinks it is the same formation.

(4) *Mt. Savage Fire-Clay horizon.*

This is entirely new; it includes many Blattoids, some Protorthoptera very close to those of Mazon Creek, but, so far as at present appears, no Palæodictyoptera. It has been considered of

Pottsville age, but I learn that Mr. H. Bassler refers it to the Allegheny. The insects, so far as known, would place it low down in the Allegheny, but apparently above Mazon Creek. This is a very promising locality for future discoveries.

(5) *Period of Mylacrids, but no Palæodictyopterans.*

This includes all the Allegheny except the base; whether it includes the base of the Conemaugh is not yet certain. The Mt. Savage fire-clay horizon probably represents the earliest part of this period, from which, in general, it is only separated by the positive indications of affinity with Mazon Creek. This period is typified by the Kittanning coal, E. coal, and mammoth vein of Pennsylvania.

(6) *Blattoids still dominant, but Mylacrids absent. Spiloblattoids present.*

There is perhaps a recognisable division between the disappearance of the Mylacrids and the appearance of the Spiloblattinids; this would be Conemaugh, with uncertain limits above and below. Spiloblattinids appear at Willis Creek and Richmond, Ohio, in shales above the Ames limestone, supposed to be Conemaugh, but perhaps later? Our period 6, as defined above, includes not only these Ohio localities, but Cassville, W. Va., Lawrence, Kansas, and Fairplay, Colorado. So far as the insects go, these must apparently be grouped together; but Cassville and Fairplay have been regarded as Permian.

(7) *Typical or Upper Permian; Blattids becoming small and scarce, very many other insects appearing, prophetic of the rise of modern orders in the Mesozoic.*

This fauna, described by Sellards and Tillyard, occurs in the Wellington shales of Kansas. It appears to indicate the increasing coldness and perhaps aridity of the climate. The Blattids had conquered the world, but had not exterminated the Protorthoptera or Protodonata, though the latter alone retained their large size. With the change of climate in the Permian the conditions, at least in our latitudes, became unfavourable for Blattids, and the other types of insects had a better chance.

In the descriptions and tables below, Sc.=subcosta, R.=radius, R_1 etc.,. branches of radius, Rs.=radial sector, M.=media, Cu.=cubitus.

BLATTOIDEA.

Family **Archimylacridæ**, Handlirsch.

In the Archimylacridæ the subcosta is elongated, and sends off a number of separate veins to the costal margin. As Handlirsch argues, this appears to be a more primitive condition than that of the Mylacrids, in which the subcostal branches are crowded together, and emitted in a fan-like manner. The Archimylacrids

appear to date back as far as the Pottsville, and to survive well into the Permian. They are abundant in Europe as well as America. In the lower Permian or uppermost Pennsylvanian they are very numerous and diversified. From the more recent Wellington shales of Kansas Sellards has described species assigned to *Etoblattina* and a new genus *Puknoblattina*. Of the species of *Etoblattina*, *E. permiana* is not figured, *E. pecta* is imperfect, but *E. curta* is certainly not an *Etoblattina*. The media of *E. curta* is of the *Progonoblattina–Sterzelia* type, though the radius differs. The venation of *E. curta* is precisely that of *Puknoblattina*, except that in the latter the radius and media are joined for a considerable distance basally.

The most primitive Archimylacrids, apparently, are those (PALÆOBLATTINÆ, subfam. nov.) in which R_1 has a number of short branches close together from apical part, and no others; while the media is relatively simple. The type-genus is from Mazon Creek. The genera of this group are separable thus:—

Costa scarcely arched	*Aphthoroblattina*, Handl. (Pa.).
Costa strongly arched	1.
1 Rs. with two branches above, one of them forked	*Palæoblatta*, Handl. (Mazon Cr.).
Rs. more complicated	*Polyetoblatta*, Handl. (W. Va.).

The range appears to be from the upper Pottsville to the lower Allegheny.

The remaining genera of the family (ARCHIMYLACRINÆ, subfam. nov.) are numerous and diverse, but do not appear to fall distinctly into separable subfamilies.

It seems quite impossible to make a key to the Archimylacrinæ that will really serve for the determination of the genera, but the following synopsis may not be altogether useless. It is based on the tegmina of the type-species of the several genera.

A 1. M. with branches all distinctly above.
(*Necymylacris*, Scudd., falls in this division, but is too fragmentary to classify exactly.)

B 1. M. remarkably simple, with not more than two or three simple branches above.

C 1. R. turned upward to costa, Cu. with concavity upward on apical half.

(1) *Olethroblatta*, Handl. Germany. Another species (*O. americana*, Handl.) is recorded from Pa., it has the first branch of media forked. The interneural structure in this genus consists of cross-veins. A second American species is described below.

C 2. R. spreading, not turned upward; Cu. with convexity upward on apical half.

(2) *Archimylacris*, Scudd. Nova Scotia. Interneural structure of well-spaced cross-veins. The *Blattina venusta* of Lesquereux is referred by Handlirsch to *Archimylacris*, but it appears not to be congeneric. Scudder considered it an *Etoblattina*.

(3) *Metachorus*, Handl. Type from Mazon Creek. Costal area not band-like as it is in *Archimylacris*, but rather triangular, approaching the Mylacridæ. A second species is from Oklahoma.

C 3. R. strongly curved, extending obliquely downward.

(4) *Loroblatta*, Ckll., described below. It is small, with tegmen only 12–13 mm. long.

B 2. M. not thus simple.
D 1. M. strongly curved downward, showing a double curve.
E 1. R. curved upward, ending on costal margin.
(5) *Asemoblatta*, Handl. Type from Saxony; other species, which really appear congeneric, come from Commentry, Mazon Creek, and Pennsylvania.
E 2. R. not curved upward, but its branches having the same direction as those of Sc.; small form with tegmina about 13 mm.
(6) *Metapoblatta*, Ckll., described below.
E 3. R. not curved upward or otherwise peculiar.
F 1. Rs. apparently with only a single fork.
(7) *Gyroblatta*, Handl. Rhode I. The type is *G. clarki*, Scudd. A second species, *G. scapularis*, Scudd., also from Rhode I., has a different media, and is probably not congeneric.
F 2. Rs. very complicated.
G 1. Sc. very short, hardly reaching middle of wing.
(8) *Syncoptoblatta*, Handl. Commentry. Rather large, tegmen about 30 mm.
(9) *Cardioblatta*, Handl. Saxony. Tegmen remarkably short and broad, 16 mm. long.
G 2. Sc. long, reaching far beyond middle of wing; M. with six primary branches.
(10) *Sterzelia*, Handl. Baden. Quite large, tegmen about 44 mm. long.
G 3. Sc. reaching beyond middle of wing, but not quite so long as in *Sterzelia*; M. with four primary branches.
(11) *Progonoblattina*, Scudd. Switzerland. Smaller than *Sterzelia*, but the two genera are perhaps not separable.
D 2. M. not strongly curved downward.
H 1. Immense species, tegmen 70 mm. long; costal area long and narrow, band-like.
(12) *Archoblattina*, Sellards. Mazon Creek.
H 2. Smaller, usually much smaller.
I 1. Cu. branches below all simple.
(13) *Eumorphoblatta*, Handl. Cu. with appendix; Sc. with very complex branches. Large insect, tegmina 48 mm. The type is from the Middle Kittaning coal of Pennsylvania. A considerably larger species from Commentry, never figured, is referred to the same genus by Handlirsch.
(14) *Dinoblatta*, Ckll., described below. Cu. with or without appendix; Sc. with branches simple, or some once forked. Large, tegmina 40–45 mm.
(15) *Atimoblatta*, Handl. Upper Pottsville of Pennsylvania. Tegmina 38 mm. long. Cu. without appendix; R. and Rs. separating basad of middle of wing; Cu. area narrower than in *Parelthoblatta*.
(16) *Metaxyblatta*, Handl. E. coal, Pennsylvania. Differs from *Atimoblatta* by broad Cu. area. Tegmina only 23 mm. long.
(17) *Parelthoblatta*, Handl. Belgium (Westphalian). Cu. without appendix; Cu. area broad, its branches all simple; R. and Rs. separating unusually apicad. Tegmina 23 mm.
I 2. Cu. branches not simple.
J 1. Cu. having a branch with six forks; R. having a branch to Sc.
(18) *Dysmenes*, Handl. Rhode I. Large insect, tegmina 55–60 mm. long.
J 2. Cu. having no such complicated branch; R. without branch to Sc.
K 1. Sc. short, hardly going beyond middle of wing.
(19) *Phyloblatta*, Handl. Type a species from Saxony, with tegmen 15·5 mm.
(20) *Metaxys*, Handl. Ohio. Tegmen 14 mm. This falls close to *Phyloblatta*, but Cu. has some quite complicated branches.
(21) *Ambloblatta*, Ckll. Described below. Costal region not known, but the genus is placed in this vicinity.
K 2. Sc. longer, going well beyond middle of wing.

L 1. Wing long and narrow.
  (22) *Miaroblatta*, Handl. Commentry. Tegmen 38 mm.
  (23) *Xenoblatta*, Handl. Type from Rhode I. Tegmen 18 mm.; Cu. with appendix.
L 2. Wing short and broad.
  (24) *Platyblatta*, Handl. Type (now designated) is *P. steinbachensis* (Kliver), from Germany.
  (25) *Oxynoblatta*, Handl. Type from the Allegheny of West] Virginia. Tegmen only about 14 mm.; Sc. not very long.

A 2. M. with branches all distinctly below.
(*Microblattina*, Scudd., is referred by Handlirsch to the Protoblattoids.)

M 1. R. with a strong double curve; Sc. very short.
  (26) *Adeloblatta*, Handl. Mazon Creek. *A.* (?) *gorhami* (Scudd.), from Rhode I., is evidently not congeneric.
  (27) *Mesitoblatta*, Handl. Commentry. The Cu. branches are not all simple, as they are in *Adeloblatta*, but the two genera are closely allied; this is one of several instances showing the affinity of Mazon Creek insects to those of Commentry.
  (28) *Drepanoblattina*, Schlecht. Saxony. A small insect with tegmina only 8 mm. long; remarkable for narrow wing and reduced Cu., crowded by the expanded M.
M 2. R. without a strong double curve.
(If R. has many small branches above from apical part, see *Polyetoblatta*, in Palæoblattinæ.)
N 1. Sc. remarkably extended, and R. consequently reduced to a very small area, in which it forks, and each branchlet is once forked.
  (29) *Amorphoblatta*, Handl. Commentry. Tegmina about 48 mm. long.
N 2. R. not thus reduced, Sc. not so much extended.
O 1. Cu. with very few simple branches (compare *Hemimylacris*, in Mylacridæ).
  (30) *Dictyoblatta*, Handl. Saxony. Surface between Rs. and M. reticulated.
O 2. Cu. with more, often compound branches.
P 1. R_1 simple; wing rather pointed.
  (31) *Sooblatta*, Handl. Saxony. Surface between Rs. and M. finely reticulated.
P 2. R_1 compound.
Q 1. Tegmina subtruncate at end; Cu. with only four primary branches below.
  (32) *Kinklidoblatta*, Handl. Pittston, Pa. Tegmina 24 mm. long. Fine reticulation between M. and Cu.
Q 2. Tegmina pointed at end.
  (33) *Acoblatta*, Ckll. Described below. Surface between veins reticulated.
Q 3. Tegmina rounded at end; Cu. with more branches than in *Kinklidoblatta*.
  (34) *Kinklidoptera*, Handl. Bohemia. First branch of Cu. simple (compare *Hemimylacris*). The type is *K. lubnensis* (Kusta). *K. vicina*, Handl., also from Bohemia, has branches of media all above, and is apparently not congeneric.
  (35) *Anthracoblattina*, Scudd. Saxony. The type is *A. spectabilis*, Goldenberg. Two other species - *didyma*, Rost. (which Scudder called an *Etoblattina*), from Saxony, and *gigantea*, Brongn., from Commentry—are referred here by Handlirsch. They appear to be congeneric with one another, but perhaps not with *spectabilis*.

A 3. Media with branches not distinctly above or below, or imperfectly known.

R 1. R. with many branches to costo-apical region, simulating end of Sc.
  (36) *Hermatoblattina*, Scudd. Germany.

R 2. R. otherwise.
S 1. R_1 simple; M. much reduced, occupying narrow space on margin. (The same kind of M. is found in *Hesperoblatta*.)
(37) *Etoblattina*, Scudd. Germany. Surface between veins reticulated.
S 2. R_1 once forked; Sc. going little beyond middle of wing.
(38) *Gongyloblatta*, Handl. Bohemia. Fine regular cross-veins, closely placed, between M. and Rs.
(39) *Stygetoblatta*, Handl. Ohio. "The surface of the wing appears leathery with a fine grain, and shows no cross-veins."
S 3. R_1 more complex.
T 1. Branches of Sc. all simple.
(40) *Elaphroblatta*, Handl. Commentry. Tegmina about 40–45 mm.
T 2. Branches of Sc. not at all simple.
(41) *Plagioblatta*, Handl. The type, *P. parallela* (Scudd.), does not come from the Middle Kittanning Coal, as commonly reported, but is from much older rocks at Campbell's Ledge, near Pittston. *P. campbelli*, Handl., has an entirely different costal area, and is evidently not congeneric; it could better be placed in *Schizoblatta*. In true *Plagioblatta* the costal field is narrow, and the last three branches of Sc. are forked.
(42) *Schizoblatta*, Handl. Ohio, from the Conemaugh; very much more recent than *Plagioblatta*. Costal field broad; last three branches of Sc. simple.
(43) *Pachyblatta*, Ckll. Described below. Costal field broad.
(44) *Sphaleroblattina*, Schlecht. Saxony. A small form, tegmen only 9 mm. long, with short Sc.
(45) *Discoblatta*, Handl. Rhode I. Tegmen 18 mm. Sc. going beyond middle of wing.
S 4. R_1 unknown, or only partly known.
U 1. Branches of Cu. numerous, simple except two which are once forked.
(46) *Apotypoma*, Handl. Bohemia. *A. longa*, Handl., the type-species, has tegmen 53 mm. long. The two species, *arndti*, Kusta, and *platyptera*, Handl., also from Bohemia, which are provisionally referred to this genus by Handlirsch, are poorly preserved, but they do not appear to be congeneric with *longa*.
U 2. Branches of Cu. numerous, two forked, one of these twice.
(47) *Auxanoblatta*, Handl. Saxony. Tegmen 45 mm. long. The Sc. goes beyond middle of wing, which is not true of *Hesperoblatta*; the Sc. of *Apotypoma* is unknown. *Hesperoblatta*, Handl., is based on a species from Commentry; it has tegmina about 30 mm. long; M. like that of *Etoblattina*, but R_1 with 7 or 8 branchlets.

The following supplementary table separates certain genera in which the Cu. branches are all simple, and there is no accessory Cu.:—

R. with a very strong double curve; Sc. only reaching middle of costa; Cu. branches 5..................	*Adeloblatta*, Handl. (Mazon Cr.; the species *gorhami*, Scudd., from R.I. is evidently not congeneric).
R. without such a curve	1.
1. Branches of M. all distinctly below...	2.
Branches of M. above; M. quite complicated	3.
2. Cu. branches few; medium-sized insect	*Dictyoblatta*, Handl. (Saxony).
Cu. branches many; very large insect	*Amorphoblatta*, Handl. (Commentry).
3. R_1 simple; Rs. very complicated ...	*Flabellites*, Fritsch. (Bohemia).
R_1 with three forks; Sc. short	*Metaxyblatta*, Handl. (E. coal of Pa.).
R_1 very complicated	*Parelthoblatta*, Handl. (Belgium).

A critical examination of the above synopsis readily reveals the fact that many of the characters cited are not of generic value, and may not even be specific. The purpose has been to separate the forms on the characters described, without affirming that they all represent different genera. Handlirsch's system gives us a great number of rather poorly founded genera; but it seems, on the whole, better than Scudder's, which places in the same genus numerous species which probably are little related. The subject is a difficult one, because there can be little doubt that convergent or parallel evolution has produced superficially similar insects, which seem to be allied, though perhaps coming of quite different stocks. In such cases the structure of the wing-surface is often an important guide; thus several genera from the Mt. Savage clay, which are widely separated in the above synopsis, have exactly the same texture and interneural reticulation, and are, I believe, really closely related. Size is also significant; it is not probable that large and small forms are congeneric.

Certain genera appear to be common to Europe and America, but more complete proof is needed that these do not represent convergent evolution from diverse stocks. The typical Mylacridæ (using this expression to exclude the series related to *Hemimylacris*) abounded in America throughout Allegheny time, yet never, so far as we know, reached Europe. This suggests that the Blattid faunæ of the two sides of the world were not intermingled to any extent during that period, and makes it rather improbable that various Archimylacrid genera crossed over, though they may have done so prior to the rise of the Mylacridæ.

By far the largest American Archimylacrid is *Archoblattina* from Mazon Creek, with tegmina 70 mm. long. It is not, however, larger than some modern cockroaches—for example, I have before me two species from Quirigua, Guatemala (*Wilmatte P. Cockerell*), with measurements as follows (in mm.):—

	Length of tegmina.	Width of tegmina.	Width of pronotum.
Blaberus trapezoideus (Burm.) .	71	26	24·5
Archimandrita marmorata (Stoll)	67·5	32	31·5

These two large modern forms also exhibit the interneural characters of the fossils; in the *Blaberus* are regular, widely-spaced cross-veins, while the *Archimandrita* shows a fine reticulation. These Guatemala species were kindly determined for me by Mr. A. N. Caudell.

Scudder remarked on the diminution in average size of the Palæozoic cockroaches from earlier to later times. While his observations on this point are undoubtedly correct, it does not appear that all the early forms were large, or all the later ones small. None of the Permian species were very large, but quite small forms occurred low down in the Allegheny (*Loxoblatta, Oxynoblatta*), while the large *Dinoblatta* evidently abounded when the "4 ft. seam" was deposited, in Middle Conemaugh time.

Olethroblatta lineolata, sp. n. (Pl. VI. fig. 17.)

Represented by a tegmen, lacking the apex, anal area, and part of costal.

Estimated length 23 or 24 mm. (20 mm. preserved). Costa arched; costal area 2 mm. wide; subcosta ending about 15·5 mm. from base of wing, with about seven simple branches; the subcosta is curved apically as in *O. americana*, Handl., not straight as in the type of the genus, *O. intermedia*, Goldenb., from Germany. Radius straight except basally, with six or seven branches from its upper side, these directed obliquely upward, resembling the branches of the subcosta; the first branch, which has a long stem, is forked, and its lower branchlet is again forked (in *americana* and *intermedia* the first radial branch is simple, in *intermedia* originating far toward the base, in *americana* nearly below the last subcubital branch; in *lineolata* it originates at about the level of the fourth subcubital branch counting backward, and thus is exactly intermediate in position between the two previously described species). Second branch of radius also twice forked, but it is the upper branchlet which has the second fork; third branch once forked; three following perhaps simple, but their ends lost. Media little curved, forking about 12·5 mm. from base of wing, three primary branches from upper side visible, the first (at least) forked, the condition, so far as visible, like that of *O. americana*, except that the media is less curved downward. Cubitus long, with at least nine apparently simple branches (only five in *americana*). There are fine delicate cross-veins as in *O. americana*. In the cubital region these cross-veins are about six to a mm.

Benson's Clay Mine, Big Savage Mt., Mt. Savage Fire-Clay horizon (*Bassler*).

This is much larger than *O. americana*, from Sharp Mountain Gap, Pa., but is evidently congeneric. Whether these insects are truly congeneric with the German *O. intermedia*, which is probably of much later age, may perhaps be questioned. The latter is the type of the genus. *O. intermedia* has rather the aspect of a Spiloblattinid, the media being quite widely separated from both radius and cubitus; in *O. lineolata* the media runs as close to the radius as is usual in Archimylacrids, but the cubitus, in the middle of its course, is surprisingly distant (1·2 mm.) from the media.

Another example of *O. lineolata*, from the same locality, has the second branch of radius once forked, and the fourth branch is forked.

Archimylacris delicata, sp. n. (Pl. VII. fig. 22.)

Represented by a tegmen lacking the base, and reverse of same specimen showing the base. Length about 24 mm.; costa moderately convex, apex subacute, although the actual end is blunt; lower margin descending obliquely from apical region to the very broad base, making the tegmen subtriangular. Costal area 2·7 mm. wide;

subcosta long, ending about 6 mm. from apex of wing, its branches about eleven, the three before the last forked. Radius strongly curved downward, its branches widely spreading, the lowest fork below the apex of the wing; first branch (R_1) arising slightly beyond level of tip of anal area, though there is before this a very delicate oblique cross-vein going to the subcosta (as in *Dysmenes*); stem of R_1 with a double curve, forking at about 4 mm., the upper branchlet simple, running close to subcosta, the other forked; R_2 arising only 1·1 mm. beyond R_1, forked at same level as origin of R_3, its upper branchlet soon forking, but lower doing so only just before margin; R_3 arising 4 mm. beyond R_2, and emitting three simple branchlets from its upper side; R_4 arising 4·2 mm. beyond R_3, forming one side of apical fork of sector. Media strongly curved downward, having two branches from its upper side, the second forked. Cubitus oblique, with a double curve, cubital area extremely broad (6 mm.) basally, but very rapidly contracting, the apex about 5·5 mm. from level of tip of wing; cubital branches eight, the first forked, the others simple; no appendix to cubitus, but apex produced. Margin of anal area rapidly descending; three anal veins (counting backwards) visible, the third forked. The margin of the anal area is double, a delicate vein, perhaps really a basal branch of cubitus, running parallel with it. The venation throughout is delicate, and the interneural structure is not preserved, although the specimen is a good one.

"BB 70. Split Six. Buffalo Cr., Bayard. Coll. B. B., notebook vi. p. 51." The "Split-six" coal is of Allegheny age, below the Kittanning coals.

This insect appears to be a true *Archimylacris*, differing only in minor details from the type of the genus, *A. acadica*, Scudd., from Nova Scotia.

LOXOBLATTA, gen. nov.

Represented by a tegmen. Small; costa gently convex; costal area very broad, shaped much as in *Plagioblatta campbelli*, Handl.; subcosta extending beyond middle of wing, distinctly bent beyond origin of last branch, the two last branches each forked, and before these two or three apparently simple branches converging basally, rather in the manner of the Mylacridæ. Radius strongly curved, its main stem (sector) extending obliquely downward, doubtless including the apex of wing, though that is not preserved. Radius with at least six branches from upper side, nearly equally spaced, the first two simple, running parallel with and resembling branches of subcosta, the third with two branchlets above (the first arising quite near the base), fourth to sixth branches simple so far as visible, but their ends lost. The subcosta and media, with their branches, are strong and thick, but the media and cubitus are extremely weak and delicate, and crowded into a small space by the greatly expanded radius and the long anal area. Media thread-like, running close to radius, forked at level of fifth

radial branch. Cubitus showing five very thin branches from lower side, apparently simple, but their ends, and end of cubitus, lost. Anal area very long and narrow, the thin almost obliterated veins running to margin. There are very fine cross-veins between the true veins of the wing, essentially as in *Olethroblatta*.

Loxoblatta bassleri, sp. n. (Pl. V. fig. 4.)

Estimated length of tegmen 12–13 mm. (10·5 mm. preserved), width 5·9 mm.; length of anal area about 5·6 mm., its width 2 mm.; subcosta ending 8 mm. from base of wing; width of costal area 2·4 mm.

Caldwell's Clay Mine. Big Savage Mt. (*Frostburg*). Mt. Savage Clay horizon (*Bassler*).

A singular little genus, probably somewhat related to *Olethroblatta*, but very distinct. There is vaguely indicated an approach to the Mylacrids, of which it may be an ancestor. Although the Mylacrids are usually easily distinguished by the character of the subcostal branches, some Archimylacrids approach the Mylacrid type, as might be expected. Thus Scudder's *Etoblattina deanensis*, from England, having a subcosta something like that of *Loxoblatta* (though otherwise very different), is actually referred by Handlirsch to the American family Mylacridæ, with the remark that it is really intermediate between the families. It should perhaps be kept in the Archimylacridæ, but more recently Bolton has described three species considered to be Mylacrids from England, and seems to have proved that this American family existed in that part of Europe.

METAPOBLATTA, gen. nov.

Small forms with rather elongate tegmina, rounded apically, the costa very gently convex, the lower margin nearly straight. Texture coriaceous, rough, the fine and dense cross-veins irregularly uniting to form a minute network. Costal area moderately broad (1·3 mm. in type); subcosta ending slightly beyond middle of wing, with at least seven widely-spaced branches, all simple; radius with branches all distinctly above, having the same direction as branches of subcosta; first, second, and fourth radial branches furcate; third, fifth, and sixth simple, the last forming one side of apical fork of sector; apex of wing between radial sector and media. Media curved downward, forking late (its primary fork level with third of radius), the three primary branches wholly superior; the first with two branches on lower side, the second forked. Cubital area broad, triangular, the cubitus obliquely descending, with seven perfectly simple straight branches; anal area transversely rugose, not greatly elongated, with four veins visible, the apical two evidently branchlets of one. No appendix to cubitus.

Metapoblatta microptera, sp. n. (Pl. VI. fig. 10.)

Tegmen about 13 mm. long, 5 mm. wide; subcosta ending 6 mm. from level of end of wing; anal area about 4 mm. long.

"115′ below 'six-foot' seam, W. Md. Railway tracks S. of Franklin, W. Va." (*Bassler*). Another label says "S. of B. & O. Viaduct, Franklin, W. Va." Allegheny.

This is a remarkably small form, considering its age. In Scudder's table it runs to *Poroblattina*, and it may actually represent an ancestor of the Poroblattinidæ, though it belongs to the Archimylacridæ. There seems to be some affinity with another small form, Scudder's imperfectly known *Microblattina* from Rhode Island, which Handlirsch refers, I think erroneously, to the Oryctoblattinidæ. There is some approach to *Asemoblatta*, but the media is wider and there is no appendix to cubitus. The anal region and other characters differ from *Atimoblatta* and *Metaxyblatta*.

DINOBLATTA, gen. nov.

Large species with broad tegmina; the costa little arched. Fine rather regular cross-veins, often branched, between the true veins, much as in *Asemoblatta*. Subcosta reaching about middle of wing, its branches simple. Radius complex; the upper branch forked near margin; the second forking at level of origin of last branch of subcosta, its upper branchlet simple, its lower twice forked; third or sector giving off four simple branches above, the first separating nearly at same level as primary fork of second branch of radius. Media forking a short distance basad of first fork of sector, the upper branch giving off at least three branches above, of which the third again divides; the lower branch forking early, and each branchlet at least once forked. Cubital area broad, the cubital branches numerous, simple. Near *Parelthoblatta*, but shape of wing different, and branches of subcosta not forked*. Media too complicated for *Atimoblatta*, and radius not complicated enough for *Metaxyblatta*. There is some resemblance to certain forms referred to *Phyloblatta*, but the type of *Phyloblatta* (from Saxony) is certainly different and the interneural structure is quite distinct. Type, *D. fortis*, sp. n., from which the above description was made.

Dinoblatta fortis, sp. n. (Pl. V. fig. 9; Pl. VII. fig. 21.)

Tegmen 40 mm. long or over; width 20 mm. Width of costal area at level of origin of penultimate branch of subcosta 4·85 mm.; width of cubital area nearly 7 mm. The type lacks base and apex

* *D. cubitalis* has some of the branches of subcosta forked, but the anal area is much larger than in *Parelthoblatta*; the latter, also, is very much smaller.

of tegmen, but most of the apex is preserved on another piece as a reverse impression. The veins are very strongly marked.

The label states: "BB 25. Opp. Barnum, top of plane, '4 ft.' coal. Coll. B. B., Aug. 9, 1915. Note-book p. 27."

Dinoblatta cubitalis, sp. n. (Pl. V. figs. 7, 8.)

Represented by a tegmen, lacking the upper apical and lower basal regions, as well as apical margin and extreme base. General appearance, delicate cross-veins, etc., as in *D. fortis*. Length of tegmen about 45 mm.; costal area about 6 mm. broad, subcosta extending beyond middle of tegmen, with about ten very oblique branches, counting backwards from the last the first three are simple, fourth forked, fifth simple, sixth to eighth forked, the last near base. First branch of radius (R_1) forked 11·1 mm. from its origin, its lower branchlet again forked; second branch of radius arising 5·3 mm. beyond first, forked 11·1 mm. from its origin, its apex lost; third branch of radius arising 8 mm. beyond second, its stem 10 mm. long, its apical fork lost; fourth branch arising 7·5 mm. beyond third, forked after about 5 mm.; fifth branch forming one side of the rather small apical fork of sector. Course of radius, media, and cubitus nearly straight. Media with five apical forks, the first two (the lower longer than the upper) on branchlets of the upper division; the last three on branchlets of the lower division, which differs from the upper in having a very long extra (first) branchlet from its upper side, giving rise to a small apical fork. Cubitus very long, with very oblique simple branches, and, in addition, a long appendicular vein from its upper side, arising about level with first branchlet of lower division of media, and having two branches from its lower side.

"L 14. Potomac Mining Co., Moore's Run, Barton, Md., '4 ft.' seam, Middle Conemaugh" (*H. Bassler*).

I am not positive that this is a distinct species, but the presence of an appendix to the cubitus makes it desirable to give it a distinct name. The character of the cubitus is like that of *Eumorphoblatta heros* (Scudd.), a still larger species from the Middle Kittanning coal, and I believe that there is really a rather close relationship. *Eumorphoblatta* is much older, and has the branches of the subcosta much more complicated. A species from Commentry, France, is also referred by Handlirsch to *Eumorphoblatta*.

A second example of *D. cubitalis* is labelled: "BB 26. Hardscrabble Mine, between Shaw and Barnum. '4 ft.' Middle Conemaugh. Coll. B. B., Aug. 23, 1915. Note-book ii. p. 28." It fortunately has the anal area perfectly preserved, showing that it is very long (about 23·5 mm., the width in middle 8·7 mm.), resembling that of the much older *Atimoblatta*, which may be ancestral to it. There are eight anal veins; the last (longest) is forked just before margin, while the fifth and sixth unite a short distance before the margin.

From the same locality as the type of *D. cubitalis* comes a

specimen consisting of an anal area only, which I was puzzled to identify until I had the Hardscrabble specimen for comparison. It agrees in size and appearance with that of the Hardscrabble specimen, but the venation differs in some small details. The veins are all simple, except the fifth, which is forked near end. The interneural structure of *Dinoblatta* in the anal region consists of a very fine oblique rugulosity.

Dinoblatta cubitalis, var. *alpha*, nov. (Pl. VII. fig. 23.)

This appears to be merely an individual variation, but it is desirable to precisely record the modifications found.

Tegmen about 45 mm. long and 20 mm. broad; subcosta ending about 31 mm. from base, its branches about 13, counting from the end the third (briefly), sixth, and eighth are forked. First branch of radius forked 5·5 mm. from its origin, its upper branchlet forking again to form a short apical cell, its lower branchlet emitting two twigs from its upper side. Second branch of radius 11 mm. beyond first, forked 8 mm. from its origin. Third branch forming side of apical fork of sector, or perhaps again divided, the apical region being lost. Thus R_1 is more complex than in the type, and seems to represent R_1 and R_2 united. Media with five branches from upper side, their ends missing, but it can be seen that they were more or less compound. Cubitus, as in type, with appendix, but its inferior branches simple.

"BB. 25 B. 'Four-foot coal,' top of plane; opp. Barnum. Coll. B. B., Aug. 9–25. Note-book ii. p. 27."

Compared with *D. fortis*, the costal area is distinctly broader and the cubital branches are closer together.

Dinoblatta cubitalis (?), var. *beta*, nov.

Represented by a fragment only, with reverse. The cubitus has no appendix, but is somewhat turned up at end, so that its terminal section with apical fork looks rather like a short appendix. The second and third branch from end on lower side are both forked. Compared with *D. fortis* the whole venation is widened out, indicating a broader tegmen; the branches of media leave their stem at a larger angle.

The data are the same as those for var. *alpha*.

Phylloblatta indecisa, sp. n. (Pl. VI. fig. 12; Pl. VII. fig. 20.)

Tegmen about 23 mm. long, 8·8 mm. wide; approximately parallel-sided, the costa not appreciably arched, the lower margin very faintly concave. Costal area about 2·3 mm. wide near middle; subcosta ending 12 mm. from base of wing, its last two branches simple, the next in order basad forked, the next simple, the next forked, the next simple, beyond which nothing is preserved. Radius with the sector as its main stem, all the radial branches arising without question from its upper side; first branch arising 7 mm. from base of wing, twice forked, the branches from its upper side; second

to fourth branches each early forked, forming a very long cell; fifth branch forked, but with the stem a little longer than the cell; sixth simple, forming one side of apical fork of sector, the cell being about 7 mm. long. The radius is only faintly curved. Media straight, parallel with radius (radial sector), forked about level of third branch of radius, the upper branch emitting three simple branchlets from its lower side; the lower branch forked, forming a very long cell, its length about 9·4 mm. The first fork of the media is symmetrical, and the branches cannot be definitely said to arise from either side. Cubitus very long, gently curved, reaching the apical margin of wing, but with no appendix. Cubital branches about ten, several forked, but mostly near the end, one twice forked. Width of cubital area near middle 3·1 mm. Anal area 9 mm. long, pointed at apex; seven anal veins, but the fifth and sixth forked near base, so as to practically make two. Interneural structure not visible, it was certainly very delicate.

Pottsville region of Pennsylvania (*Lehman*). No. 26 *a*. No exact locality is given, but it comes with the lot including *P. prior*, and is in precisely similar rock, so it is doubtless from South Good Spring. The species is so close to *P. prior* that I hesitated to describe it as distinct; it is larger, and differs in various details of the venation, though the radius and media are of the same characteristic type as in *P. prior*. In Scudder's tables this runs nearest to the insect now known as *Plagioblatta parallela* (Scudd.), which is really from Campbell's Ledge, near Pittston, not from the locality usually quoted. *Plagioblatta* is a very ancient type, resembling *Phyloblatta*, but differing by the distinct regular cross-veins, the longer subcosta, form of media, and especially the oblique radius. *Plagioblatta campbelli*, Handl., appears not to belong to that genus.

Phyloblatta prior, sp. n. (Pl. V. fig. 6.)

Tegmen relatively long and narrow, about 20 mm. long, 7·1 mm. broad; costa little arched; costal area narrow; subcosta ending 10·5 mm. from level of apex of wing, its branches not preserved. Radius complex, its branches distinctly from upper side; R_1 branching off 16·6 mm. from tip of wing, forked 4 mm. from its origin, and each branchlet again forked; second branch of R. arising 3 mm. beyond first, formed like the first, forked and the branchlets again forked, but the first fork narrower; third branch arising 4 mm. beyond second, and once forked; fourth like third; fifth simple, forming one side of the apical fork of sector. Thus the radius with sector occupies 9 mm. of the margin, but falls about 1·7 mm. short of the apex. Media occupying 4 mm. of margin, not allowing for curve, its uppermost apical fork having its lowest branch at the wing-tip. Media first branching 14 mm. from wing-tip, the branches from the upper side; first branch forking 7 mm. from tip, its upper branchlet again forking; second branch arising 3·4 mm. beyond first, forking at same level

as first branch, and its upper branchlet again forking; third branch simple, forming one side of the long (7 mm.) apical fork of media. Media and cubitus nearly straight, 1 mm. apart at level of first fork of media. Cubitus ending about 4 mm. from wing-tip, distinctly on outer margin; cubitus with eight branches, the first and seventh forked, the others simple, the eighth forming one side of the terminal fork; at the origin of the seventh branch the stem is slightly directed upward, but the branch is not in a straight line with the stem, so that the condition approaches but does not distinctly attain that of the species having an appendix to the cubitus. Width of cubital area about 3 mm. Interneural structure not preserved.

Pottsville region of Pennsylvania (*Lehman*). The exact locality is South Good Spring, and an appended note states that the material probably came from the "Mammoth Vein," which is Upper Allegheny. The "Mammoth Vein" has hitherto produced a number of Mylacrids, all very distinct from the present insect. The reference to *Phyloblatta* is perhaps not wholly satisfactory, as this genus is typical of a much later period, and most of the species have the cubitus much more curved. However, *P. schroeteri* (Giebel), from Saxony, the type of the genus, has the cubitus little curved, and seems essentially congeneric with *P. prior*. Another species of the same type is *P. ignota*, Schlecht. The oldest *Phyloblatta* found in America, *P. diversipennis*, Handl., is from Mazon Creek, and doubtless older than *P. prior*. In Scudder's arrangement *P. prior* would go in *Etoblattina*; but it is very different from *E. primæva*, Goldenberg, the type of that genus.

AMBLOBLATTA, gen. nov.

Large species with elongated tegmina; the lower margin (beyond anal area) perfectly straight, regularly and rapidly curving upward apically to a point at end of M_1, the margin below this point or angle (which is a very obtuse one) so nearly vertical that the tegmen appears truncate; from the apical point the margin passes obliquely upward and inward, at an angle of about 45° with the vertical. The whole tegmen is finely and densely reticulate between the veins; in the anal area, and between the first branches of cubitus, the cross-venules are connected by small transverse branches, but the reticulation is less distinct than elsewhere. The costal region has not been preserved. The radius is practically straight; R_1, of which only the base is visible, separates from the sector early (in the type-species 23·5 mm. from apex of tegmen); the radial sector has three long simple branches on the upper side. The media forks about 3·2 mm. apicad of level of fork of radius, and has a very long upper branch, which has three branches, the first on the lower side, the second on the upper, and the third on the lower, but really constituting an apical fork, the stem and branch being alike, this fork enclosing the apical point of the wing. The lower branch of the media passes obliquely downward, though not

descending at all rapidly, and gives off four very long branches on the upper side, the first and third forked at end. Cubitus long, reaching the lower part of apical margin (5 mm. below apical point); it has seven branches on its lower side, of which the first, third, fourth, and fifth are forked; and, in addition, a long accessory forked branch from upper side, arising just before sixth branch on lower. The anal area shows only the apical part, with five simple veins in a distance of less than 3 mm.

This description is based on the type. Another specimen (apical part of tegmen) shows that R_1 is compound, having at least three forks; it also shows that the end of M_1 may have five forks, and the lower section of media may have the second branch forked.

Ambloblatta bassleri, sp. n. (Pl. VI. fig. 13.)

Apex of anal area to vertical level of tip of tegmen 21·6 mm., probable length of tegmen about 29 mm.; length of accessory branch of cubitus 12·5 mm.; width (depth) of cubital area at level of origin of fifth cubital branch 4·5 mm.; vertical distance from first radial fork (origin of Rs.) to lower margin of wing 8·5 mm.

Benson's Clay Mine, Big Savage Mtn. Mt. Savage Fire Clay horizon. Type with reverse, and apex of tegmen of a second individual. Named after the collector, Mr. H. Bassler.

The genus *Ambloblatta* is related to *Phyloblatta*, and especially to *Asemoblatta*, Handlirsch, Proc. U.S. Nat. Mus. xxix. p. 724. *Asemoblatta* is described as having the apical margin obliquely truncate; but the type-species is *A. anthracophila* (Germar) from the Stephanian of Saxony, and the apical margin of this insect is not preserved. A second species, also from the Stephanian of Saxony, shows a rounded apical margin. These European species are of much later date than *Ambloblatta*.

On the other hand, *Asemoblatta danielsi*, Handl., from Mazon Creek, has the apical margin obliquely truncate—more distinctly so than in Handlirsch's figure, as I learn from a photograph of the type kindly sent by Mr. L. E. Daniels. Yet *A. danielsi* has not quite the cut of *Ambloblatta*, and the structure between the veins is unknown, so I hesitate to refer it to that genus.

ACOBLATTA, gen. nov.

Medium size, with broad tegmina. Costa gently but distinctly arched, the curve regular to the apex, which is pointed, the margin forming a rectangle, but owing to the curves giving the impression of an acute angle. Apical margin, below the point, much more oblique than in *Ambloblatta* (the apex being essentially as in *Asemoblatta danielsi*, but a little more acute). Surface between the veins reticulated, much as in *Ambloblatta*. Costal field narrow (depth in type-species only about 1·2 mm.), subcosta long, its end in type 10 mm. from level of tip of wing, its branches numerous, very oblique, one (at least) forked. R_1 leaving sector (in type)

17 mm. from apex of wing, simple nearly to end, when it branches twice. Rs. with four branches above, the first two again forked. M_1 highly complicated, having five branches below, the third with a long fork, the others simple; the apical fork (between stem and last branch) includes the wing-tip. Lower branch of media divided early into three nearly parallel veins, of which the uppermost has a very long fork. The media altogether occupies 6·3 mm. of the wing-margin. Cubitus long, with six very oblique branches, of which the fifth only is forked beyond the middle, but, as the sixth forms a fork with the end of the stem, there appear two forks at the end of the cubital area, the upper much the longer. Apex of anal area in type about 12 9 mm. from level of apex of tegmen.

Acoblatta argillacea, sp. n. (Pl. VI. fig. 16.)

Length of tegmen probably about 23 mm., width 10 mm.; length of cell in fork of upper branch of lower section of media 7·6 mm.

The genus is close to *Ambloblatta*, but the short broad tegmen, with more pointed apex, is distinctly different; and the first (upper) section of M. is much more complicated, while Cu. lacks an accessory nervüre. These venational characters also separate it from *Asemoblatta danielsi*. A parallel European genus is *Kinklidoptera*, Handl., from the Westphalian of Bohemia, and therefore possibly of about the same age. *Kinklidoptera*, however, has a much broader costal area, and the wing between the veins is not reticulated.

A. argillacea is from Caldwell's Clay Mine, Big Savage Mt.; Mt. Savage Clay horizon.

Both impressions are preserved, but the base of the wing is lacking.

PACHYBLATTA, gen. nov.

Described from a tegmen, lacking the apical part of lower margin.

Large, with strongly convex, regularly curved costal margin and obtusely pointed apex; subcosta long (in type ending 23 mm. from base of wing and 7·5 mm. from level of apex), with numerous slender branches, many of them furcate; radius not unusually curved; R_1 separating much before middle of wing (10·4 mm. from base in type), forked soon after (2 mm. in type) its origin, the lower division again forked, the upper division and two branchlets of lower each again forking at nearly the same level, producing three long cells. Radial sector robust, forking in type 5·1 mm. from its origin, the upper division again forking 3·5 mm. beyond, and each branchlet forking to form a long apical cell; lower main division of sector forking 5 mm. from its origin, each branchlet again forking to form an apical cell, the lower much shorter than the upper; R. (including sector) occupying 5·5 mm. of margin, and falling 1·2 mm. short of apex; media strongly curved at base, but afterwards nearly straight, not strongly directed downward,

its first fork (12·2 mm. from base of wing in type) symmetrical, so that the branches cannot be said to be distinctly on upper or lower side, but the branches of the lower division (only two preserved) are very distinctly on the upper side of it; upper division of media a little stouter than lower, forked in type 7·5 mm. from origin, the fork symmetrical, the lower branchlet once forked, forming an exceedingly long apical cell, the upper forked 5 mm. from wing-tip, and its lower division again soon forked, the upper margin of the cell thus formed being at the tip of wing; cubitus strongly curved at base, rapidly descending, with about eight branches, which are simple or slightly complicated (margin lost), and there is apparently no appendix; anal area 10 mm. long, its apical margin very rapidly descending, its apex forming an angle of fully 70° with wing-margin; five strong anal veins are visible, apparently all simple, ending on wing-margin. Surface of wing reticulated all over, except in cubital and anal fields, where there are numerous cross-veins.

Type, *P. convexa*, sp. n., from which the above description was made

Pachyblatta convexa, Cockerell, 1918 *. (Pl. VI. fig. 15.)

Tegmen 30·5 mm. long and about 8 broad; texture evidently dense.

Benson's Clay Mine, Mt. Savage; fire-clay horizon (*Bassler*).

This is evidently related to *Ambloblatta* and *Acoblatta* from the same locality, having the same texture and interneural reticulation, as well as the angulate apex. From *Ambloblatta* it is readily known by the strongly curved Cu. and little produced end of anal area, as well as the character of the apex. The costal area is much broader than in *Acoblatta*. There is a curious superficial resemblance to "*Phyloblatta*" *occidentalis* (Scudder) from the very much more recent beds at Lawrence, Kansas. *Discoblatta*, from Rhode Island, presents some resemblances; its apex is unknown. The very closely related European genera *Progonoblattina*, Scudder (Switzerland), and *Sterzelia*, Handl. (Baden), show many points of similarity to *Pachyblatta*, but doubtless represent a parallel development.

Pachyblatta radiata, sp. n. (Pl. VI. fig. 11.)

Represented by a tegmen lacking cubital, anal, and costo-basal areas. As preserved it is black, with the same texture and interneural reticulation as *P. convexa*. The most obvious distinctive character is found in the strongly curved media, the uppermost terminal branchlet of which falls nearly a mm. *below* the wing-tip.

Length about 28 mm., estimated breadth 12·5, the wing certainly very broad. Costal area narrower than in *P. convexa*, subcosta shorter, ending a little more than 15 mm. from base of wing,

* Briefly indicated in a footnote, Proc. U.S. Nat. Museum, vol. liv. p. 304.

crowded by the spreading radius; eight subcostal branches visible, simple, but long and very oblique, though parallel, not crowded together at base as in the Mylacrids. Radius arched, bifurcating about 5 mm. from base, R_1 about as complicated as the sector and branched in much the same way. R_1 with four primary branchlets from its upper side, the first simple, the second forked, the third simple, and the fourth forming upper side of the long (7 mm.) apical cell. Radial sector with three branches from its upper side, the first two forked, the cell in fork of first long; lowest branchlet of sector ending practically at wing-tip, actually a minute distance above tip. Media strongly curved downward, but with a straight first branch which gives off three branchlets below, the second forked; about five additional branches of media can be seen, running parallel as in *Ambloblatta*, the first three forked.

Caldwell's Clay Mine. Big Savage Mtn. (*Frostburg*); Mt. Savage Clay horizon (*Bassler*).

Family **Mylacridæ**, Scudder.

The Mylacridæ are usually recognised without difficulty, though there are some genera which are clearly intermediate between this family and the Archimylacridæ. The special characteristic is found in the costal area, which is more or less triangular, with the branches of the subcosta approaching basally, spreading in a fan-like manner. Scudder in 1895 * remarked that the Mylacridæ had appeared to be exclusively American, until Brongniart announced, without descriptions or figures, that they existed in numbers at Commentry, France. Handlirsch, reviewing the whole subject very much later, did not find that any of the Commentry insects were genuine Mylacridæ, but referred to this family Scudder's *Etoblattina deanensis* from England. Still more recently Bolton has reported other English Mylacrids. It is to be observed that these species from England all belong to that division of the Mylacrids which most approaches the Archimylacrids, and it is, perhaps, still an open question whether they may not represent a parallel development, having no genetic connection with the genuine (American) Mylacridæ.

The Mylacridæ arose, developed, and disappeared within Pennsylvanian time. They appear to be absent from the true Pottsville; the occurrence of species in the Mt. Savage Clay tends to confirm H. Bassler's reference of that horizon to the Allegheny. In the Allegheny they become abundant, but early in the Conemaugh they rapidly diminish and presently disappear. It is possible that with the revision of the stratigraphy it will appear that the disappearance of the Mylacrids occurred at the very end of the Allegheny. They certainly occur in the Freeport.

The following provisional table for the separation of the

* Bull. U.S. Geol. Survey, no. 124, p. 121.

Mylacrid genera of America is based on the type-species of the several genera. It cannot be rigidly applied, since species exist which do not entirely conform to characters of the genera in which they are placed, and yet do not seem sufficiently distinct to form the basis of new genera. It is based on the tegmina :—

	Branches of media distinctly below ...	1.
	Branches of media above, or not distinctly above or below.. ...	7.
1.	Radius peculiar, with few branches, *apparently* below ...	*Platymylacris*, Handl.
	Radius with many branches, all above ...	2.
2.	Tegmina remarkably short and broad ; R_1 compound, end of R. considerably above apex of wing ...	*Brachymylacris*, Handl.
	Tegmina not thus short and broad ...	3.
3.	R_1 simple ; R. with seven branches ; Cu. with only three or four branches ; Sc. double	*Orthomylacris*, Handl.
	R_1 complex ...	4.
4.	Tegmina very long ; M. with many forks ; R. with double curve ...	*Stenomylacris*, Handl.
	Tegmina not so long ; M. more simple	5.
5.	R_1 more than once forked ...	*Actinomylacris*, Handl.
	R_1 once forked ...	6.
6.	Cu. either with a complicated appendix or it may be considered that the second branch is very complex ...	*Anomomylacris*, Handl.
	Cu. ordinary ...	*Phthinomylacris*, Handl.
7.	Sc. approaching the Archimylacrid type, with four well-spaced branches (*Amblymylacris* may perhaps go here ; if so, it is distinguished by R. with eight branches, R_1 simple) ...	8.
	Sc. of typical Mylacrid type ...	9.
8.	R_1 simple ; Sc. going near end of wing ...	*Exochomylacris*, Handl.
	R_1 compound ; Sc. going only to beginning of last third of wing ...	*Hemimylacris*, Handl.
9.	R. very compound, with eight main branches, but R_1 simple (compare *Lithomylacris*, but R. with six branches) ...	*Amblymylacris*, Handl.
	R. with fewer branches ...	10.
10.	Media with its branches distinctly above ; Sc. highly compound (all from Illinois, except *Lithomylacris* and *Aphelomylacris*) ...	11.
	Media with its branches not distinctly above.	13.
11.	R_2 with three forks ...	*Promylacris*, Scudd.
	R_2 with two forks ...	*Lithomylacris*, Scudd.
	R_2 with one fork ...	12.
12.	Tegmen subquadrate ...	*Paromylacris*, Scudd.
	Tegmen long-oval ...	*Mylacris*, Scudd.
	Tegmen long, margins subparallel. ...	*Aphelomylacris*, Handl.

[Scudder separated the above genera thus :

	Sc. and R. areas together occupying less than half of tegmen... ...	1.
	Sc. and R. areas together occupying more than half of tegmen ...	2.
1.	R. area larger than Sc. area ...	*Mylacris*, Scudd.
	R. area smaller than Sc. area ...	*Promylacris*, Scudd.

2. Tegmen narrow (etc.)	*Lithomylacris*, Scudd.
Tegmen broad, M. area expanding apically	*Paromylacris*, Scudd.
Aphelomylacris, in this table, will fall close to *Mylacris*.]	
13. Sc. extremely complex, R_1 apparently simple; tegmina over 30 mm. long . ..	*Goniomylacris*, Handl.
Sc. little complex, R_1 not simple, tegmina 21 mm. long or less	14.
14. M. very complex, R_1 very complex	*Chalepomylacris*, Handl.
M. with only two forks, or relatively simple .	15.
15. Anal area long and costal area short	*Cyphomylacris*, Ckll.
Anal area shorter, costal area long, ending beyond middle of wing	*Sphenomylacris*, Handl.

Some of the above genera should probably be united, but an adequate revision will not be possible until much more material has been collected.

The largest Mylacrids (tegmina 35 mm. or over) come from Mazon Creek, the smallest, or at least those with shortest tegmina (*Brachymylacris*), are from the Anthracite series near Tremont, Pa. (4 species), and the Lower Allegheny of Maryland. It is not clear, at present, that there is any definite relation between size and specialization in this family; nor was there, apparently, any regular diminution in size as the group approached the end of its life. The later forms, from the Freeport or its equivalent, were quite large. Thus, while the Mylacrids, as a whole, are of considerable value for stratigraphy, we are not yet in a position to utilize the genera and species as time-makers, except that the presence of identical genera may suggest approximate contemporaneity.

Brachymylacris martini, sp. n. (Pl. VII. fig. 27.)

Represented by a tegmen lacking anal area and extreme apex. Tegmen about 14 mm. long (13 preserved) and 6·7 wide. Subcosta of normal Mylacrid type, ending about 6·5 mm. from extreme (humeral) base of wing; the five or six branches radiate fan-like from a common point, and appear to be simple. The radius is highly compound, though there are only three main branches, all from upper side, though the second branch comes off in such a way that it looks rather like the main stem, which would then appear to have three branches from its lower side; first radial branch looking rather like the terminal part of subcosta (and actually interpreted as such in Handlirsch's figure of *B. cordata*), soon forked, and each branchlet again forked; second radial branch with two branchlets arising from its lower side; third with one such branch; end of radius (lowest branch of sector) apparently above the tip of wing, but not curved upward as in *B. elongata*. Media little curved (not strongly curved as in *B. cordata*); forked at same level as origin of second branch of radius; each division again forked, the lower earlier than the upper, and the upper twig of lower division forked not far from end. Cubitus gently curved, with three simple branches; anal area evidently long. Interneural

sculpture distinct, consisting of fine not very dense cross-veins, connected more or less to form a network.

"BB 51. Deep Cr. and Yough. [? Youghiogheny R.], 3′ above 'Conoquenessing.' Lower Allegheny."

Collected by H. Bassler. Named after Geo. C. Martin of the Maryland Geological Survey, in recognition of his work on the geology of the region.

Mylacris lapsa, sp. n. (Pl. VII. fig. 28.)

Represented by a very good tegmen, lacking the lower part of apex. Tegmen 25 mm. long, 10·4 broad; anal area 10·4 mm. long., 5 broad; interneural structure poorly preserved, but finely rugulose or reticulate. Subcosta long, ending 17·3 mm. from base of wing, but of typical Mylacrid form; the first branch with two branchlets above from near base, the second originating about 3 mm. beyond first, the third a short twig at end, making an apical fork. Radius gently curved at base, then straight, but bent near base of its extremely long (nearly 12 mm.) apical fork, reaching margin with its lowest twig about 2·5 mm. from apex of wing. The radius has only three branches, all above and all long, the first two forked 5 or 6 mm. from end. Media obliquely descending, with at least three branches above, all forked, the first with the lower branchlet forked again. Cubitus long, with four branches below, the first and fourth forked. Anal area with eight veins, all going to the margin, the uppermost very complex, dividing into three veins, of which the first and third are forked; fifth and sixth veins also forked.

"Parker Seam. Montell Tunnel. Loarsville (Allegheny)." Collected by Bassler. Readily distinguished from other species by the comparatively simple radius.

Orthomylacris franklini, sp. n. (Pl. V. fig. 2.)

Represented by a tegmen lacking the cubital and anal areas. Probable length of tegmen 29 mm. (26·5 preserved). Humeral region large, but not produced backward as in *O. analis*, the basal side being approximately at right angles to the longitudinal axis. Subcosta of normal Mylacrid type, ending about 17 mm. from extreme (humeral) base of wing; first two subcostal branches evanescent. Third and fourth distinct and simple, fifth and sixth with long forks; subcosta not double. Radius little curved, with its branches all from the upper side; first branch straight and apparently simple, but emitting two short twigs from its upper side near end; second branch arising only 1 mm. beyond first, and forked after 5·2 mm., its lower branchlet 13 mm. long; third branch arising 2·8 mm. beyond second, and simple; fourth arising 4·4 mm. beyond third, also simple; fifth and sixth branches simple as far as preserved. Media straight, its first branch from lower side, second from upper, third forming a symmetrical fork; of

the four twigs resulting, the first seems to be simple, but the other three are forked near end.

"115 below 'six-foot' seam. W. Md. Railway tracks S. of Franklin, W. Va." Another label states: "S. of B. & O. Viaduct, Franklin, W. Va." Collected by H. H. Bassler.

This species appears to be closely related to several others of about the same size, the apparent differences being as follows —

(1) *O. analis*, Handl., has a more prominent humeral angle, distinctly bipartite subcosta, and different R_2.

(2) *O. alutacea*, Handl., differs in the subcosta and the position and character of the radial branches.

(3) *O. mansfieldi*, Scudd., differs from the convex costal margin (it is straight in *O. franklini*) and character of R_1.

(4) *O. lucifuga*, Scudd., differs by character of subcosta.

(5) *O. pluteus*, Scudd., differs by R_1 branched near base, but the type of *pluteus* is too imperfect for further comparisons.

The characters of the venation certainly vary within the species, even the two sides of the same individual frequently showing differences; but specimens showing tangible and conspicuous differences, coming from different localities and horizons, are almost certainly referable to distinct species.

Orthomylacris recta, sp. n. (Pl. V. fig. 3.)

Represented by a tegmen, lacking the apex. Tegmen about 25 mm. long (22 mm. preserved), 10·5 mm. wide; humeral process well developed, obtusely subangular; costa very straight; no interneural reticulation or cross-veins visible, though the specimen is a very good one. Costal area long-triangular; subcosta of the normal Mylacrid type, ending 15·7 mm. from base of wing (humeral process); first three branches of subcosta simple, radiating, the first faint; fourth branch forked about the middle; fifth arising very close to fourth, and briefly forked at end; tip of main stem emitting a weak twig from upper side very near end. Radius scarcely curved, all its branches strictly from the upper side; first branch (morphologically, no doubt, first two united) dividing less than a mm. from its origin, the upper division forked near end, the lower (13·7 mm. long) simple; second branch of radius forked near end; third simple as far as preserved; fourth forked 3 mm. from base; additional branches may have been present in the apical part of wing. Media straight, forked symmetrically a little beyond level of third radial branch, the upper division forked after 5 mm., the lower after 4 mm., the inferior branchlet of the lower branching at least once again. Cubitus long and little curved, with five very oblique branches from lower side, the last forked near end. Anal area very long, cuneate, its length 14 mm., width 4·1; uppermost anal vein highly compound, branching near base,

the lower division soon forking to form a very long (nearly 9 mm.) slender cell; upper division soon branching again, its lower branchlet forked after 2·8 mm., its upper after 3·2 mm., the upper twig of the latter not reaching the wing-margin, but curving and ending in margin of anal area.

"Parker Seam; Sunnyside. 1½ miles E. of Mt. Savage (Allegheny)." Collected by H. Bassler.

This differs from typical *Orthomylacris* by the complex first branch of radius, and the media without the branches distinctly from below. There is, however, no other genus with which it may be better associated, and it scarcely seems to deserve a distinct generic name. The long anal area is suggestive of *Cyphomylacris*.

Orthomylacris berryi, sp. n. (Pl. V. fig. 1.)

Represented by a well-preserved tegmen, which is 22·5 mm. long and 7·4 broad, the form unusually long, with subparallel margins and rounded apex. Interneural structure, well preserved in cubital region, of fine close-set transverse lines. Humeral protuberance large; subcosta long, ending 8 mm. from level of apex of wing, but quite typically Mylacrid; the first branch of subcosta has two strong branches above, but all fail to reach the margin; the second branch has a very long fork; the third and fourth are simple, the latter forming one side of the short apical fork; the general effect is that of a double subcosta, the lower part or main stem seeming distinct from the twice-forked first branch. Radius with the stem essentially in a straight line with the simple and straight first branch, which is quite thick, so that the radius appears to have its branches arising from below; on the view that the branches are inferior, there are only two main branches, arising close together near level of penultimate branch of subcosta, but this is morphologically incorrect, and we must rather say that the radius has a gentle double curve, with three main branches, of which the first continues in a straight line as a simple twig, but gives off near its base a strong branchlet, which soon bifurcates, producing a very long fork, the lower limb of which again forks about the middle, while all three terminations have short forks just before the margin. The second branch of radius, arising 5·2 mm. after the first, is once forked near its middle; while the third branch forms one side of the apical fork of sector, and has a short fork just before the end. The lowest twig of radius ends on the margin fully 1·6 mm. from apex of wing. The media is gently curved, the concavity upward, and is forked symmetrically, the branches not being distinctly above or below. The first fork is about 9 mm. from extreme base of wing; the upper branch forks after 5·5 mm., and its lower branchlet is twice forked, the middle of the three twigs thus formed ending at the tip of the wing. The lower branch of media forks after 2·9 mm., its upper division soon forks again, producing two very long branchlets, the upper of which forks once more. The lower division of lower branch of

media is simple for 5 mm., and beyond that obliterated. The cubitus is long and little curved, the cubital area long and narrow; there are four cubital branches, the first with a very long fork, the second twice forked, the third forked, the fourth forming one side of apical fork; there is no appendix. The anal area is very long and narrow, ending 12 mm. from level of apex of wing.

"BB 70. Split Six. Buffalo Cr., Bayard. Oct. 7. Note-book ii. p. 51." This is near the dividing-line between the Allegheny and the Conemaugh, or at least high up in the Allegheny, as I learn from Mr. Bassler.

O. berryi, named after Dr. Edward W. Berry of the Maryland Survey, is a peculiar species, which I thought at first might be regarded as the type of a new genus. The unusual form of the radius, with the branches *apparently* below, and the apex of the wing wholly occupied by the media, differ from the type of *Orthomylacris*; but, on the other hand, the general characters are so much like those of various species of *Orthomylacris* that it does not seem desirable to propose a new generic name. The radius is rather suggestive of that of *Platymylacris*. In Scudder's tables the species runs closest to *Mylacris heeri*, which is an *Orthomylacris*, but the radius is quite different.

CYPHOMYLACRIS, gen. nov.

Represented by a tegmen. Tegmen of moderate size, elongate, subcuneate; costa moderately arched, descending apically, the apex low. Costal area triangular, the subcosta ending a little beyond first third of wing; costal branches radiating, few, the penultimate one forked. Radius strongly curved basally, but beyond nearly straight; with six branches on upper side, and one very long simple one (arising halfway between fourth and fifth of upper side) from lower side, with which it runs parallel, halfway between it and the media. First branch of radius with two branchlets, close together, from its upper side; second with two long branchlets from lower side, so close together that it almost seems that the branch divides near base into three equal branchlets; third with a very long fork; fourth with two long branchlets from upper side, about as far apart as first is from base; fifth and sixth simple. Lowest branches of radius including tip of wing. Media straight, narrow, little complicated, forking at level of fourth branch of radius, the fork symmetrical, and each branch again producing a long symmetrical fork, the cell very much longer than the stem of the branch. Cubitus little curved, the cubital area long and tapering, some of the cubital branches forked near end. Anal area long and narrow, the numerous delicate veins going to margin. Humeral lobe very prominent. No distinct interneural structure.

Cyphomylacris atrata, sp. n. (Pl. VI. fig. 14; Pl. VII. fig. 29.)

Tegmen as preserved black, about 20·5 mm. long; subcosta ending 7·5 mm. from base of wing; anal area about 9·6 mm. long and 3·5 broad.

Clay Mine No. 7, Union Mining Co., Big Savage Mt., Mt. Savage Clay horizon (*Bassler*).

Allied to *Sphenomylacris*, but distinguished by the strong humeral protuberance, the long anal area, and much shorter costal area.

Other specimens of Mylacridæ, too fragmentary for description, were found in the Mt. Savage Clay.

Order PROTORTHOPTERA, Handlirsch.

Handlirsch, in his great work 'Die fossilen Insekten,' divides the modern Orthoptera into a number of groups which he treats as distinct orders. The most recent presentation of the subject on the lines laid down by Handlirsch is that of Brues and Melander *, who recognise subclasses Orthopteroidea and Blattæformia, each including numerous orders. The orders of Orthopteroidea are Grylloblattoidea, Orthoptera, Phasmoidea, Diploglossata, Dermaptera, and Thysanoptera; while those of Blattæformia are Mantoidea, Blattoidea, Zoraptera, Isoptera, Corrodentia, Mallophaga, and Siphunculata.

We are not now concerned to discuss the validity of all these ordinal divisions, but are interested to observe that the Orthopteroidea and Blattæformia were segregated in the Palæozoic, the Blattoids attaining a very high degree of development. The primitive Palæodictyoptera appear to have given rise to the Orthopteroidea and the Blattæformia, and, as might be expected, transitional types are found. Handlirsch established the order Protorthoptera for those forms which seemed to stand between the Palæodictyoptera and the Orthopteroidea—the Palæozoic ancestors of the true Orthoptera. The generalised character of these insects is indicated by the fact that Scudder, who certainly knew the Orthoptera well, did not refer them to the Orthopteroids at all, but to the Neuropteroidea. Another series of genera was regarded by Handlirsch as intermediate between the Palæodictyoptera and the Blattæformia, and for these he established the order Protoblattoidea. These Protoblattoids are very diverse, and with the addition of new genera it becomes increasingly difficult to define the order in any satisfactory manner, as distinct from the Protorthoptera. It is also to be noted that when the Protoblattoids first appear (so far as the record shows) the Blattoids are already very well established, so that it is impossible to regard the Protoblattoids as their actual ancestors. In the combined series of Protorthoptera and Protoblattoidea we have, in fact, a miscellaneous assemblage of insects of which it can be said (excepting, perhaps, some which Handlirsch places among the Protoblattoids) that they are neither Blattoids nor Palæodictyopterans. Examining them more in detail, we cannot doubt that they survived in part to form the stuff out of which a number of modern orders evolved in the

* 'Key to the Families of North American Insects' (1915).

Mesozoic. There is no reason for believing that any of them (as at present known) were the ancestors of Blattoids; and there is good reason for supposing that they gave rise to much more than the modern Orthoptera. The name Protorthoptera is therefore rather unsatisfactory, but it may be used to include the Protorthoptera and Protoblattoidea of Handlirsch. Should new deposits be found, containing many species of these insects in a good state of preservation, it will doubtless become necessary to entirely revise the existing classification.

Narkema alternatum, Cockerell, 1924. (Pl. VI. fig. 19.)

Represented by the region beyond the middle of the wing, showing portions of the radius, media, and cubitus. Broad black bands cross the wing, as in *N. tæniatum*, Handl., but they are a little broader than the intervals between them (width of bands about 1·85 mm., of the intervals about 1·40 mm.). Both the longitudinal and cross veins on the bands appear as colourless lines. Approximately the last 6 mm. of the radius can be seen as a stout simple vein approaching the costa (but with its slight curve in the opposite direction to that seen in *N. tæniatum*, the convexity below), and emitting above numerous oblique veins to the costa, which they meet at an angle of 45–50°. The radial sector, at first bent downward, later approaches the radius, so that near the end the space between these veins is a scant ½ mm.; five branches leave the sector on the lower side, directed as in *N. tæniatum*, and united by strong cross-veins at remote intervals, making quadrate cell of various sizes, but all considerably longer than deep; the branches of the sector appear to be simple, but they may have branched again near the margin. The media (apparently—its origin lost) is forked a little before the level of the origin of penultimate branch of the radial sector. The small portions of the cubitus preserved show no special features. The length of the fragment is about 11 mm., showing four black bands, the wing was probably about 30 mm. long, certainly much smaller than that of *N. tæniatum*.

Benson's Clay Mine, Big Savage Mtn. Mt. Savage Fire Clay horizon.

N. alternatum certainly appears to be congeneric with the type of *Narkema*, which was found at Mazon Creek, Ills.

Spaniodera (?) *simplex*, sp. n. (Pl. VI. fig. 18; Pl. VII. fig. 26.)

Represented by the apical half of a broad wing, lacking the cubital region. Costa gently arched; apex rounded; apical margin oblique, less rounded than in typical *Spaniodera*; subcosta joining radius 12 mm. from apex of wing, its termination exactly as in *Spaniodera*; radius simple, formed exactly as in *Spaniodera*, its apical part connected by oblique cross-veins with the costa, as

in *S. schucherti*; radial sector formed as in *Gyrophlebia longicollis*, Handl., with a broad fork (at level of end of subcosta), the lower branch simple, but the upper twice forked, first at 8·25 mm. from apex of wing, and then the upper branchlet dividing at about 3 mm. from apex. Media simple, in a distinct fold.

Benson's Clay Mine, Mt. Savage. Fire Clay horizon.

This disagrees with *Spaniodera* in the simple media, and, except for the wholly *Spaniodera*-like character of the subcosta and radius, might be referred to *Gyrophlebia*. More complete material would very possibly indicate a new genus.

OCHETOPTERON, gen. nov.

Represented by an anterior wing, lacking the costal region and extreme base. Wing of moderate size, narrow, the veins strong, except the cubitus and anals, which are delicate. A conspicuous broad longitudinal furrow following the line of the cubitus. Subcosta with only a fragment preserved, but it is long, with oblique branches above. Radius emitting three very oblique branches above, the first near the middle of the wing, and all simple. Radial sector arising very near base of wing, straight, slightly approaching radius apically, emitting two simple branches below, the first basad of first branch of radius, and about on a level with second branch of media. Media emitting three branches below, the first (lowest) very long, and forked beyond its middle; the other two simple. Cubitus with three simple branches below. A long anal running nearly parallel with wing-margin and one or two short ones. The media is connected with the radial sector by an oblique vein (its upper end more apicad) near the base. A delicate oblique cross-vein (its upper end more basad) passes from the radial sector to the media, which it reaches at the first fork. Similar cross-veins pass from the media to the cubitus, two prior to the branching of the media and a longer one with a double curve from the lower branch of media.

Ochetopteron canaliculatum, sp. n. (Pl. VII. fig. 25.)

Wing as preserved about 17 mm. long, its actual length must have been 19 or 20 mm.; width near apex about 6 mm.; distance from first to third branch of radius 5·15 mm.; first branch of media to end of media 10·8 mm.; distance from cubitus to margin at level of first branch of media 1·1 mm.

Parker Seam, Sunnyside, 1½ mile east of Mt. Savage. Allegheny formation.

A genus of Protorthoptera, not unlike *Parahomalophlebia* from Commentry, France, but with the anal region very much narrower and the character of the cross-veining different. The cubitus is like that of *Petromartus indistinctus*, Melander (not *insignis*, as it is printed in Proc. U.S. Nat. Mus. xxix. p. 699), but the radius is very much more complex than in that insect. The cross-veins

between the radial sector and media, and media and cubitus, are like those in the same situation in *Archimastax* from Arkansas. The channelling of the wing is a feature preserved in modern grasshoppers.

Cheliphlebia (?) *argillacea*, sp. n. (Pl. VII. fig. 24.)

Represented by an anterior wing, lacking the base, apex, and costal region. The fragment is about 9·5 mm. long, indicating a wing about 15 mm. long. The venation, so far as preserved, agrees in character with that of *Polyetes*, which does not appear to be essentially different from *Cheliphlebia*. Toward the base of the wing the subcosta is quite remote (about ·7 mm.) from the radius, and at the same level the radius is a little less distant from the sector, the latter being about as far from the media as the subcosta is from the radius. The sector is forked as in *Polyetes*, and each branch is again forked, the upper about 2·3 mm., the lower about 3·3 mm., beyond the primary fork. The media branches 2·5 mm. basad of level of fork of sector; its upper branch is forked 4 mm., and again 6 mm., beyond primary fork; its lower branch is forked 1 mm., and again 2·5 mm., beyond primary fork; in each case it is the upper branchlet which has the second fork. The inferior subapical margin of the wing is straight, not rounded, and forms a very obtuse but distinct angle with the lower margin, the region of this angle receiving the ultimate branches of the cubitus. The cubitus is extremely oblique, with an apical fork about 3 mm. long, and two other (simple) branches visible, all compressed into an area only about 1·6 mm. deep. Anal region lost, but it must have been small. The character of the cross-veins cannot be made out.

Benson's Clay Mine, Big Savage Mtn., Mt. Savage Fire Clay horizon.

Cheliphlebia and *Polyetes* were described from Mazon Creek. They are much larger insects than *C. argillacea*. The wing of *C. argillacea*, as preserved, is speckled with black, quite copiously so toward the apical region. It is doubtful whether this speckling represents markings present in the living insect.

MELANOBLATTULA, gen. nov.

Represented by the anterior wing, which is small, broad, obtusely subangulate at apex; venation blattiform, but subcosta reduced and anal area little specialised. Radius with two very oblique branches on upper side (arising before the middle of the wing), and a small apical fork. Radial sector leaving the radius early, its first branch about level with second branch of radius, and continuing to the margin without forking; its second branch a little beyond the middle of the wing, and soon forking, to form a very long cell, but lower division of second branch again forking, to form a cell which includes the wing-tip; continuation of radial sector simple; the branches of the sector all arise on the upper

side. Media forked at nearly same level as radial sector, the upper branch soon forking again, the lower simple; the two cells enclosed by the media occupying about a third of the outer margin. Cubitus with a long apical fork, and two or three somewhat curved (the concavity upward) branches below; parts of two anal veins can be seen, one strong.

Melanoblattula nigrescens, sp. n. (Pl. V. fig. 5.)

Wing a little over 7 mm. long and about 3 wide, with fuscous veins; upper half of wing and approximately apical fourth black, the rest brownish hyaline; toward the base the black area is narrowed, occupying less than the upper half.

Benson's Clay Mine, Big Savage Mtn., Mt. Savage Fire Clay horizon.

This is a puzzling little fossil, apparently referable to the Protoblattoidea, but certainly to no described genus of that group. The colouring of the wing recalls the hind wings of modern Blattids, such as *Periplaneta americana*, but there is no trace of an enlarged anal lobe.

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. *Orthomylacris berryi.*
Fig. 2. —— *franklini.*
Fig. 3. —— *recta.*
Fig. 4. *Loxoblatta bassleri.*
Fig. 5. *Melanoblattula nigrescens.*
Fig. 6. *Phyloblatta prior.*
Fig. 7. *Dinoblatta cubitalis.* Type.
Fig. 8. —— ——. Hardscrabble Mine.
Fig. 9. —— *fortis.*

Plate VI.

Fig. 10. *Metapoblatta microptera.*
Fig. 11. *Pachyblatta radiata.*
Fig. 12. *Phyloblatta indecisa.*
Fig. 13. *Ambloblatta bassleri.*
Fig. 14. *Cyphomylacris atrata.*
Fig. 15. *Pachyblatta convexa.*
Fig. 16. *Acoblatta argillacea.*
Fig. 17. *Olethroblatta lineolata.*
Fig. 18. *Spaniodera* (?) *simplex.*
Fig. 19. *Narkema alternatum.*

Plate VII.

Fig. 20. *Phyloblatta indecisa.*
Fig. 21. *Dinoblatta fortis.*
Fig. 22. *Archimylacris delicata.*
Fig. 23. *Dinoblatta cubitalis*, var. *alpha*. Radius.
Fig. 24. *Cheliphlebia* (?) *argillacea.*
Fig. 25. *Ochetopteron canaliculatum.*
Fig. 26. *Spaniodera* (?) *simplex.*
Fig. 27. *Brachymylacris martini.*
Fig. 28. *Mylacris lapsa.*
Fig. 29. *Cyphomylacris atrata.* Radius and subcosta.

XL.—*On Two Adult Cestodes from Wild Swine.*

By H. A. Baylis, M.A., D.Sc.

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The two species to be described in this paper are of considerable interest on account of the scarcity of well-authenticated records of adult Cestodes occurring in swine, either wild or domesticated. The following species have, so far, been recorded :—

(1) *Thysanosoma giardi* (Moniez, 1879).

This species was first recorded from a domestic pig, under the name of *Tænia brandti*, by Cholodkowsky (1894). Stiles (1895 *a* and *b*), who pointed out the identity of Cholodkowsky's species with that of Moniez, remarked that this was the first record of an adult Cestode from a pig, and threw doubt upon its natural occurrence in this host, thinking it probable that the animal had, when killed, recently ingested the worms with offal from one of the normal host-animals (sheep or cattle). Cholodkowsky (1895), however, argued that this was impossible in the circumstances in which the pig was killed. At all events, the species does not seem to have been recorded again from swine.

(2) *Moniezia expansa* (Rud., 1805).

Bodkin and Cleare (1916) record the occurrence of a worm, which was determined by the present writer as *M. expansa*, in a pig at the abattoir at Georgetown, British Guiana. They remark that its presence in the pig was possibly due to the animal having eaten refuse derived from another host. On re-examination of the fragmentary material now available in the British Museum (Natural History), the writer finds that, in the light of Theiler's (1924) recent revision of the genus *Moniezia*, this specimen should probably be referred to *M. benedeni* (Moniez, 1879) rather than to *M. expansa*.

(3) *Undetermined* Anoplocephalinæ.

Hall (1922) has recorded the occurrence of an Anoplocephaline tapeworm in a pig at Antigua. He states that the

genitalia in this specimen were so rudimentary that identification was impossible. He remarks, further:—"Apparently the sterility is associated with development in an unusual host, since no intestinal tapeworms are normally present in swine." Stiles (1895 *b*) and others have also recorded cases of the occurrence of Anoplocephaline worms in domestic pigs, without being able to refer them definitely to any species.

(4) ***Paramoniezia suis***, Maplestone and Southwell, 1923.

Maplestone and Southwell (1923) have described this new genus and species from a "wild pig (*Sus scrofula*)" near Townsville, North Queensland. It is not quite clear what species is meant by *Sus scrofula*, and the writer is not aware that any genuine wild pigs exist in Australia. Possibly the animal was a feral example of the domesticated pig.

(5) *Schizotænia decrescens* (Diesing, 1856) occurs in peccaries (*Dicotyles* spp.) in South America.

To the species mentioned the following may be added:—

(1) *Paramoniezia phacochœri*, sp. n. (Figs. 1 & 2.)

Maplestone and Southwell (1923), as has already been noted, erected the genus *Paramoniezia* for a species found in Australia. The writer received, some little time ago, a collection of parasites from the wart-hog (*Phacochœrus æthiopicus*) from Zululand, including three specimens of a Cestode which appears to belong to the same genus. It differs from *P. suis*, however, not only in size but in various details of its anatomy, as the following description will show:—

External Features.—The specimens are all rather young, none of them possessing any gravid segments, though all appear to be complete. The length of the longest specimen (now mounted in Canada balsam) is about 52 mm., and its maximum width about 4·5 mm. The smallest specimen measures 17 mm. in length and 1·15 mm. in maximum width. The greatest width of the scolex varies between 0·6 and 0·73 mm. The suckers are oval, with their longest diameter antero-posterior. They measure 0·3–0·375 mm. × 0·2–0·3 mm. Their openings are longitudinal slits. A short unsegmented

"neck" is present. Throughout the strobila the segments are much broader than long.

Fig. 1.

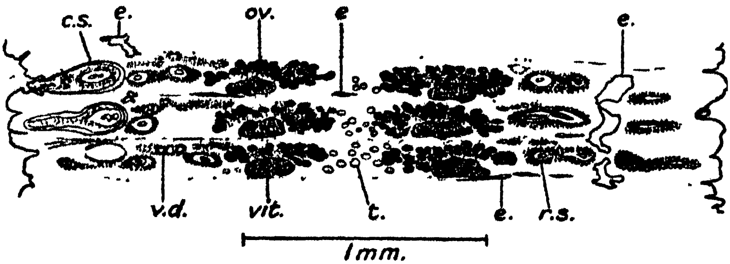
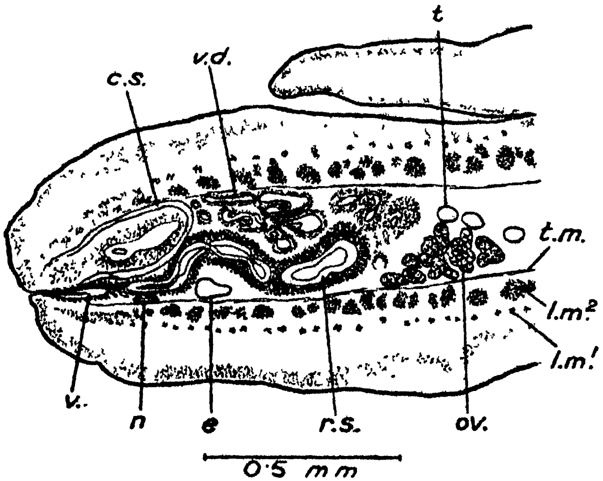


Fig. 2.



Paramoniezia phacochœri, sp. n.

Fig. 1.—Horizontal section through three mature segments. *c.s.*, cirrus-sac; *e.*, *e.*, excretory canals; *ov*, ovary; *r.s.*, receptaculum seminis; *t.*, testis; *v.d.*, vas deferens; *vit.*, vitelline gland.

Fig. 2.—Portion of a transverse section through a mature segment. *c s.*, cirrus-sac; *e.*, excretory canal; *l.m.*[1], outer longitudinal muscles; *l.m.*[2], inner longitudinal muscles; *n.*, lateral nerve; *ov.*, ovary; *r.s.*, receptaculum seminis; *t.*, testis; *t.m.*, transverse muscles; *v.*, vagina; *v.d.*, vas deferens.

Internal Anatomy.—Musculature. The longitudinal muscles are well developed and are fairly clearly divided into an outer

layer of small bundles of fibres and an inner layer of large bundles. There is a thin layer of transverse muscle-fibres internally to the longitudinal muscles (not externally to them, as is stated by Maplestone and Southwell to be the case in *P. suis*). Some dorso-ventral muscle-fibres are also present.

Excretory System.—There are apparently no dorsal longitudinal excretory vessels. The ventral vessels are well developed and connected by transverse vessels, but are not branched as they are stated to be in *P. suis*.

Genital Organs.—The segments appear to reach maturity rather late, only the most posterior in the two larger specimens being fully mature. The smallest specimen has no mature segments. Each segment contains two sets of female organs and possesses two genital pores, one on either lateral margin. As in *P. suis*, the vagina is always ventral to the cirrus-sac on the right side, but may be either dorsal or ventral to it on the left side. The lateral nerve is always ventral to the genital ducts, whatever the position of the vagina. The relatively large cirrus-sac is of an elongate pear-shape and measures about 0·5 mm. × 0·14–0·18 mm. It contains an internal vesicula seminalis. The vas deferens is considerably coiled, relatively wide, and covered externally with deeply-staining glandular cells. There is no external vesicula seminalis. The vagina expands rapidly into an elongate receptaculum seminis, which, in the oldest segments observed, has a maximum diameter of about 0·2 mm. It is lined with cilia, and has a well-developed muscular coat and an external coat of glandular cells which stain deeply with hæmatoxylin.

The testes are dorsal in position, extending only across the space between the two ovaries. They are arranged in three or four transverse rows of about ten each, and roughly in two layers dorso-ventrally. Their number per segment may therefore be estimated at between sixty and eighty. The ovaries are of the form common in the family, with numerous radiating finger-like lobes. The vitelline glands are large and compact, lying ventrally and posteriorly to the ovaries. The formation of a uterus does not appear to have begun in the segments available, and only ovarian eggs are present.

(2) *Pseudanoplocephala crawfordi*, gen. et sp. n. (Figs. 3–6.)

Through the kindness of Mr. M. Crawford, M.R.C.V.S., of the Government Veterinary Department, Colombo, and of Dr. A. L. Sheather, M.R.C.V.S., of the Royal Veterinary

Fig. 3.

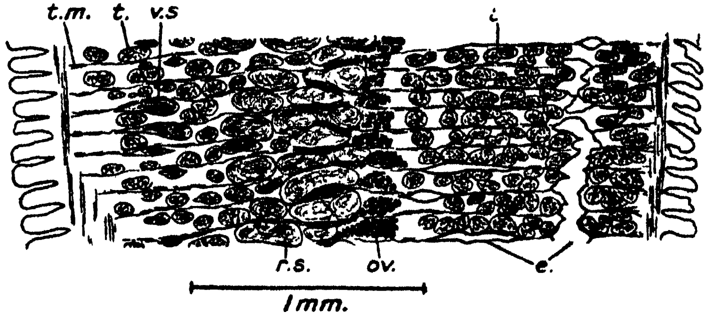
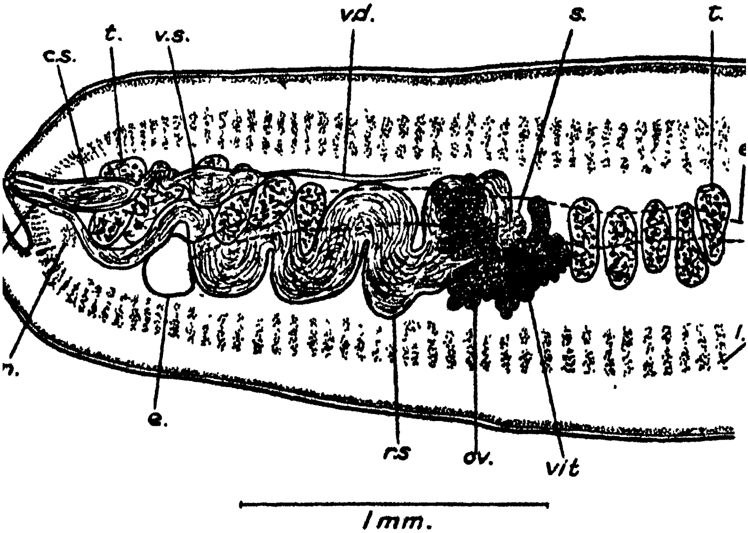


Fig. 4.



Pseudanoplocephala crawfordi, gen. et sp. n.

Fig. 3.—Horizontal section through several mature segments. *e.*, excretory canals; *ov.*, ovary; *r.s.*, receptaculum seminis; *t.*, *t.*, testes; *t.m.*, transverse muscles; *v.s.*, vesicula seminalis.

Fig. 4.—Semidiagrammatic transverse section through part of a mature segment (reconstructed from serial sections). *c.s.*, cirrus-sac; *e.*, *e.*, excretory canals; *l.m.*, longitudinal muscles; *n.*, lateral nerve; *ov.*, ovary; *r.s.*, receptaculum seminis; *s.*, shell-gland; *t.*, *t.*, testes; *v.*, vagina; *v.d.*, vas deferens; *vit.*, vitelline gland; *v.s.*, vesicula seminalis.

College, the writer has received specimens of an interesting Cestode from a wild boar (*Sus cristatus*) in Ceylon. Mr. G. W. Sturgess, M.R.C.V.S., who shot the animal, states that the worms were numerous in this individual, although others killed by him in the same district were free from them. The following is a short description of the parasite :—

External Features.—The worm has the appearance of a typical Anoplocephalid. The scolex is relatively very small, having a maximum transverse diameter of 0·4 mm. The suckers measure 0·13–0·14 mm. in diameter, and their openings are anteriorly directed. The scolex is followed by a narrow "neck," there being no external sign of segmentation for some distance. The actual length of a complete specimen cannot be estimated. The longest fragment available among the preserved material measures about 20 cm., but this cannot be taken as an indication of the length to which a living specimen may attain, as the specimens are very much contracted. The strobila has a maximum width of about 7 mm., and all the segments are very much wider than long. In the posterior (gravid) segments there is a tendency for the length to increase slightly, with a corresponding decrease in the width.

Internal Anatomy.—Musculature. The longitudinal musculature is very well developed, occupying about half the thickness of the cortical parenchyme where this is thickest. The muscle-fibres are very numerous and arranged in very vaguely-defined bundles, with only a slight indication of a division into outer and inner layers. A regular layer of transverse muscles, within the longitudinal muscles, is absent, the transverse musculature being reduced to a sheet of fibres at each intersegmental division, lying dorsally and ventrally to the transverse excretory canal, so as to form a kind of "septum."

Excretory System.—There is only a single pair of longitudinal excretory canals. These apparently represent the ventral pair, and are very wide and conspicuous. They are joined in each segment by a transverse vessel which is about half as wide as the segment is long. No trace of dorsal longitudinal vessels, or network representing them, has been observed.

Genital Organs.—The genital pores are unilateral, all being situated on what is presumably the right side. There is but a single pore and a single set of organs in each segment. The genital ducts pass dorsally to the excretory vessel and longitudinal nerve of the pore side, the vagina lying ventrally

to the cirrus-sac. The cirrus-sac is elongate and fusiform, measuring 0·55–0·6 mm. in length and 0·07 mm. in width. It contains a large internal seminal vesicle. Near the cirrus-sac the vas deferens expands into a pear-shaped or fusiform external seminal vesicle, but leaves this again as a rather

Fig. 5.

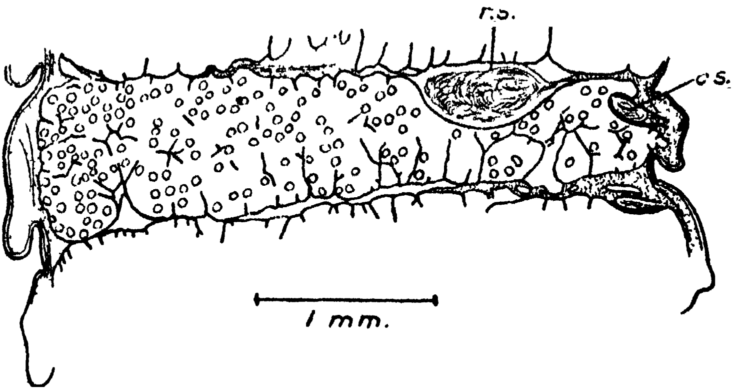
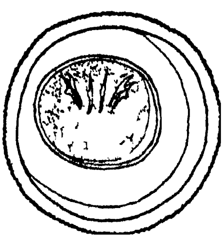


Fig. 6



Pseudanoplocephala crawfordi, gen. et sp. n.

Fig. 5.—Horizontal section through a gravid segment, showing the uterus partially divided by narrow partitions. *c.s.*, cirrus-sac; *r.s.*, receptaculum seminis.
Fig. 6.—Egg, highly magnified.

narrow tube and runs almost straight towards the middle line of the segment.

In mature segments the vagina expands rapidly into an enormous, elongate receptaculum seminis, which runs in a

series of dorso-ventral loops to the middle of the segment. The female glands are situated in the median field of the segment. The ovary is composed of a large number of finger-like lobes. The vitelline gland is also somewhat lobate, and both this and the shell-gland are in intimate connection with the ovary. The testes extend, for the most part in a single row, across almost the entire width of the segment, and beyond the longitudinal excretory vessel on each side. Their number is usually twenty-six or twenty-seven per segment, and of these sixteen to nineteen are situated on the aporal side and seven to ten on the poral side of the ovary.

The uterus is a transversely elongate sac, with numerous outpocketings in all directions. In gravid segments these push between the muscles of the dorsal and ventral walls of the segment until they almost reach the subcuticular layer, while the parenchyme separating them becomes reduced to extremely narrow partitions. The eggs have a granulated outer shell, spherical in shape and measuring 0·0975–0·11 mm. in diameter. The inner shell, or embryophore, is not a "pyriform apparatus" (*i. e.*, does not possess horn-like processes), but is of simple oval shape, measuring 0·055–0·06 mm. × 0·045–0·055 mm. Between the two shells there is a membranous envelope. The embryonic hooks measure about 0·025 mm. in length.

Systematic Position of Pseudanoplocephala crawfordi.

According to the classification given by Meggitt (1924) of the Cestodes of mammals, the form under discussion apparently belongs to the family Anoplocephalidæ, and, on account of the persistence of a sac-like uterus, to the subfamily Anoplocephalinæ. According to Meggitt's key to the genera of this subfamily, the only genus to which it can belong is *Anoplocephala*. Baer (1924), however, has divided this genus into (1) *Anoplocephala*, s. str., having a complex reticular system of excretory canals, and (2) *Anoplocephaloides*, with a non-reticular excretory system. In the latter the ovary is situated on the poral side of the middle of the segment, dorsal longitudinal excretory vessels are present, and the eggs have a well-developed "pyriform apparatus." It seems clear, therefore, that the present species cannot be referred to either *Anoplocephala* or *Anoplocephaloides*, as defined by Baer. It possesses several slight peculiarities in its morphology, none of which by itself, perhaps, could be

considered as of generic importance, but which, taken together, seem to justify the erection of a new genus, which may be defined as follows :—

PSEUDANOPLOCEPHALA, gen. nov.

Anoplocephalinæ. A single set of reproductive organs in each segment. Genital pores unilateral. A single pair of longitudinal excretory vessels present. Genital ducts pass dorsally to excretory vessel and nerve. Vaginal pore ventral to cirrus-sac. Testes extending across the segment beyond the excretory vessel on each side, but more numerous on the aporal side. Female glands median. Uterus sac-like, with numerous diverticula. Eggs without pyriform apparatus.

The type-specimens of both the new species described above are in the British Museum (Natural History).

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XLI.—*Notes on Three little-known Trematodes.*
By H. A. Baylis, M.A., D.Sc.

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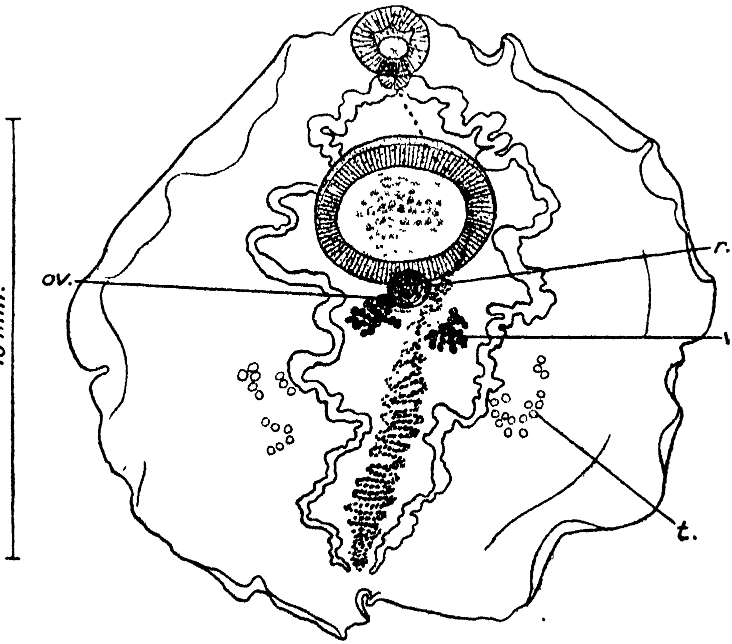
1. *Staphylorchis largus* (Lühe, 1906). (Fig. 1.)

Lühe (1906) has given a careful description of a single specimen of a tremotode found in the body-cavity of *Rhinoptera javanica* in Ceylon. He named the species *Anaporrhutum largum*. Lühe's species has since been recorded by

Fig. 1.



Staphylorchis largus (Luhe, 1906). Ventral view.
ov., ovary; *r.s.*, receptaculum seminis; *t.*, testes; *v.*, vitelline glands.

Southwell (1913) from various other Elasmobranch fishes in Ceylon (*Chiloscyllium indicum*, *Ginglymostoma concolor*, and *Aetobatis narinari*), while he refers to the same species, with some slight hesitation, specimens found in the cœlom of

Stegostoma tigrinum by Dr. Jenkins, off the Orissa coast in 1910.

The British Museum (Natural History) possesses a number of specimens from *Stegostoma tigrinum,* received from the Madras Museum some years previously. These appear to belong to the same species as those mentioned by Southwell, and there is little doubt that his determination as *A. largum* was correct. The present specimens attain to rather larger dimensions than those of Lühe's example, and the following measurements may be given :—

	mm.
Length	10–17
Maximum width	11–19
Outside diameter of oral sucker	1·0–1·8
,, ,, ventral sucker	2·7–4·5
,, ,, pharynx	0·5–0·8
Diameter of testes	0·2–0·34
,, ovary	0·3–0·4
,, receptaculum seminis	0·5–1·4

Lühe found in his specimen fourteen testes on the right side and seventeen on the left. Though there seem to be always fewer on the right than on the left, their number is not constant.

Travassos (1922 *a* and *b*), in revising the family Gorgoderidæ, has retained Lühe's species *largum* as a member of the genus *Anaporrhutum.* He has, however, erected a new genus *Staphylorchis* to contain the species described by Johnston (1913) as *Petalodistomum cymatodes.* The genus *Staphylorchis* differs from *Anaporrhutum* chiefly in the fact that the testes in the former are situated entirely laterally to the intestinal branches, while in the latter they extend beyond them towards the median line. In the writer's opinion, therefore, if the genus *Staphylorchis* is valid, Lühe's species belongs to it rather than to *Anaporrhutum,* and should be called *Staphylorchis largus* (Lühe, 1906).

2. *Harmostomum recurvum* (Duj., 1845). (Fig. 2.)

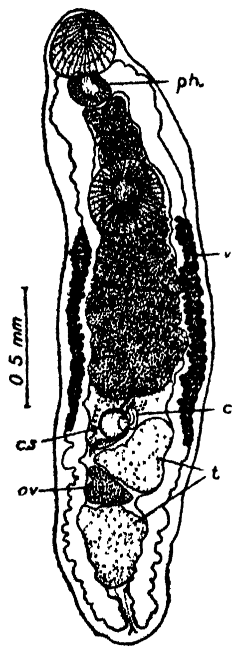
Syn. *Distoma recurvum,* Dujardin (1845, p. 410).
Heterolope æquans, Looss (1899, p. 746, pl. xxx. fig. 70).
? *Distoma musculi,* Rudolphi (1819, p. 119).

This species was found by Dujardin in the intestines of ten out of fifty-three wood-mice (*Apodemus sylvaticus*) at Rennes, France. The writer has recently had the opportunity of examining a considerable number of specimens collected from the same host near Oxford by Mr. C. S. Elton.

The following is a rough translation of Dujardin's (1845) description:—

"Body reddish or coloured yellow by the eggs, 4–5 mm. long, 0·7–1·0 mm. wide, strongly recurved or laterally inrolled, a little depressed. Cuticle sprinkled with sharp lamellæ anteriorly. Anterior sucker ventral, 0·33 mm. wide;

Fig. 2.



Harmostomum recurvum (Duj., 1845). Ventral view.

c., cirrus; *c.s.*, cirrus-sac; *ov.*, ovary; *ph.*, pharynx; *t.*, testes; *v.*, vitelline glands.

ventral sucker 0·38 mm. wide, situated at 0·55 mm. from the former. Œsophageal bulb [pharynx] 0·22 mm. wide. Testes near posterior extremity. Eggs brownish, 0·028–0·03 mm. long. Caudal pore very distinct and wide. Vessels numerous, anastomosed (?)."

The present specimens agree very closely with this

description. The cuticular spines are numerous anteriorly, becoming sparser behind the ventral sucker. In some specimens, however, a few may be seen, at least on the ventral surface, as far back as the level of the posterior testis.

Braun (1901), who examined the single original specimen of *Distoma musculi*, Rudolphi—which was said to have been found in the house-mouse (*Mus musculus*) and not in the wood-mouse, and was until that time a *nomen nudum*,—referred it doubtfully to the same species as Dujardin's *D. recurvum*, and apparently was inclined to place the latter in the genus *Harmostomum*, Braun, 1899 (=*Heterolope*, Looss, 1899). Nicoll (1923) apparently follows Braun as regards the synonymy of *D. musculi* and *D. recurvum*, but leaves the genus undetermined. Witenberg (1925) places *D. recurvum* with *D. musculi* as a synonym, among "*species dubiæ*" of *Harmostomum*. *D. recurvum*, in the writer's opinion, undoubtedly belongs to *Harmostomum*, but, as the measurements given in the appended table will show, it seems somewhat doubtful whether *D. musculi* and *D. recurvum* can be regarded as synonyms. There are apparently considerable differences in the dimensions of the pharynx and of the eggs, though in the latter case, perhaps, some error may have crept into Braun's description, for it seems doubtful whether the width given by him (0·009 mm.) can be correct.

On the other hand, there seems to be no reason why *Heterolope æquans*, described by Looss (1899) from the gerbil (*Gerbillus ægyptius*) in Egypt, should not be regarded as identical with *H. recurvum*. The measurements given by Looss, as the table shows, fall between the extremes observed by Dujardin and the present writer in specimens from the wood-mouse. The absence of irregularities in the walls of the intestinal branches in Looss' figure of *H. æquans* appears at first sight an important point, but this may be accounted for either by the better state of extension of his material or by the fact that his drawing was intentionally partly diagrammatic. The present writer's material is somewhat contracted, which partly, no doubt, accounts for the shorter length of the specimens as compared with that of Dujardin's.

The genus *Harmostomum* has recently been divided by Witenberg (1925) into two subgenera, of which the following are the more important distinguishing characters:—

Subgenus HARMOSTOMUM.—Oral sucker usually with its opening in the form of a longitudinal slit. Genital pore at the level of the anterior border of the anterior

testis. Intestinal branches run straight from their bifurcation to the posterior end of the body.

Subgenus POSTHARMOSTOMUM.—Oral sucker with round or transversely oval opening. Genital pore commonly behind the anterior border of the anterior testis. Intestinal branches sinuous.

H. recurvum, it will be seen, falls into the first of these subgenera.

Measurements (in millimetres) of H. recurvum, H. æquans, *and* Distoma musculi.

Name.	*Distoma recurvum.*	*Harmostomum recurvum.*	*Heterolope æquans.*	*Distoma musculi* (Rud., 1819).
Describer.	Dujardin, 1845.	Baylis (present paper).	Looss, 1899.	Braun, 1901.
Length	4–5	1·5 3	3–3·75	5
Maximum width	0·7–1·0	0·6–0·9	0·7	0·7
Diameter of oral sucker	0·33	0 24–0·34	0·25	0 24×0·35
" ventral sucker.	0·38	0·27–0·35	0·266	0·396
" pharynx	0·22	0·16–0·2	...	0·145×0·125
Eggs, length	0·028–0 03	0·025–0·037	0·029	0·0228
" width	....	0·015–0·02	0·017	0·009

3. *Lyperosomum vitta* (Dujardin, 1845). (Fig. 3.)

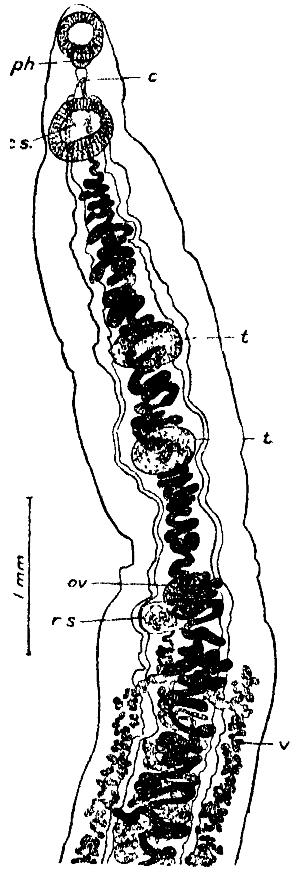
Syn. *Distoma vitta*, Dujardin (1845, p. 418).

This species is very imperfectly known. Like the last, it was first found by Dujardin in the intestine of a wood-mouse (*Apodemus sylvaticus*) at Rennes, France. Dujardin appears, however, to have seen but a single specimen, of which the anterior portion was missing. His brief description of it may be roughly translated as follows :—

"Body yellow, filiform, more than 10 mm. long, 0·75 mm. wide. Suckers? Coils of oviduct [uterus] occupying the whole of the posterior part of the body behind the testis. Eggs elliptical-oblong, 0·042 mm. long and 0·02 mm. wide."

The worm does not appear to have been redescribed or to have been referred to any modern genus. Dollfus (1925), who has carefully collected the records of Trematodes from

Fig. 3.



Lyperosomum vitta (Dujardin, 1845). Ventral view of anterior portion.

c., cirrus; *c.s.*, cirrus-sac; *ov.*, ovary; *ph.*, pharynx; *r.s.*, receptaculum seminis; *t.*, *t.*, testes; *v.*, vitelline glands.

the genus *Mus* (sens. lat.), mentions only Dujardin's description, while Nicoll (1923) places *D. vitta* among "unclassified species" under the name of *Distomum*. The latter author

records it, perhaps erroneously, as a parasite of the house-mouse as well as the wood-mouse.

The species has been found by Mr. Elton in *Apodemus sylvaticus* near Oxford, but does not appear to be common. Unfortunately the material at present available is fragmentary, but it serves to amplify somewhat Dujardin's description and to indicate the systematic position of the species. This appears to the writer to belong to the genus *Lyperosomum*, Looss, 1899 *. The following is a brief account of its main characters :—

The length of a complete specimen is unknown. The longest fragment available—an anterior portion including all the more important organs (fig. 3)—measures about 6 mm. The maximum width, usually occurring just behind the ovary, is 1·1–1·3 mm. The diameter of the oral sucker is 0·3–0·31 mm., that of the ventral sucker 0·4–0·45 mm. There is a small pharynx, measuring 0·15–0·17 mm. in diameter. A short œsophagus is present, the bifurcation of the intestine occurring about midway between the two suckers, at about the same level as the genital pore. The cirrus-sac measures about 0·3–0·35 mm. × 0·1–0·14 mm. The testes and ovary are oval, with their longest diameter transverse to the longitudinal axis of the body. They are all median in position. The testes measure 0·3–0·47 mm. × 0·23–0·3 mm., while the ovary measures about 0·32 × 0·25 mm. There is a large receptaculum seminis immediately behind the ovary and to the right of the middle line. The vitelline glands are composed of numerous follicles, situated laterally to the intestinal branches. Their anterior ends are a little behind the level of the ovary, and their ducts cross the body at this point. The coils of the uterus run back to within about 2 mm. of the posterior end of the body, and return thence to the genital pore, keeping almost entirely to the inner side of the intestinal branches. The uterus apparently extends posteriorly for a considerable distance beyond the vitelline glands, but the extent of the latter is unknown. The eggs have relatively thick, brown shells, and measure, on an average, about 0·045 × 0·0225–0·025 mm.

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XLII.—*The Cestode Genus* Catenotænia.

By H. A. BAYLIS, M.A., D.Sc.

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VON JANICKI (1904) erected the genus *Catenotænia* to contain two species—*C. pusilla* (Goeze, 1782), a common parasite of the house-mouse, and *C. dendritica* (Goeze, 1782), from the common squirrel. Since von Janicki's work only one species has been added to the genus, viz., *C. lobata*, Baer, 1925, from an undetermined rat from the Belgian Congo. In the present paper a fourth species is described, from the black rat in India, and some observations on the other species are included.

1. *Catenotænia pusilla* (Goeze, 1782).

Of this species a full description has been given by von Janicki (1906), to which the writer has nothing to add

except with regard to the excretory system. This is described by v. Janicki as consisting of a single pair of longitudinal canals, joined in each segment by a dorsal and a ventral transverse canal, these transverse canals frequently anastomosing. A study of material from the type-host (*Mus musculus*) shows that, in addition, there is a pair of very narrow dorsal longitudinal canals, simple and unbranched, lying some distance to the median side of the lateral ventral canals.

In addition to *Mus musculus*, this species has been recorded from *Rattus norvegicus*, *R. rattus*, *Arvicola arvalis*, *Apodemus* [*Mus*] *sylvaticus*, and *Myoxus glis*. While some of these records may be correct, it seems probable that some of them may be due to confusion with one or more distinct species (see below, *C. lobata*, *C. symmetrica*). On the other hand, the writer has recently received from Mr. C. S. Elton specimens taken from the bank-vole (*Evotomys glareolus*) on several occasions near Oxford, and these appear to be referable to *C. pusilla*.

2. *Catenotænia dendritica* (Goeze, 1782).

Of this species the description given by Riggenbach (1895) appears to be the most complete, and the writer's material does not warrant any addition to it. The species seems to have been recorded only from *Sciurus vulgaris*.

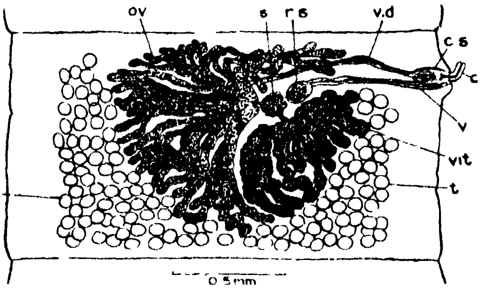
3. *Catenotænia lobata*, Baer, 1925. (Fig. 1.)

This species was described by Baer (1925) from a single specimen, apparently in a poor state of preservation, collected from a rat, whose native name is given as "Tschakoja," in the Belgian Congo. It is, at first sight, liable to be confused with the common *C. pusilla*, and it seems probable to the writer that it has sometimes been so confused. Mr. C. S. Elton has recently forwarded to the writer a large number of specimens of a *Catenotænia*, collected on many occasions from the intestine of the wood-mouse (*Apodemus sylvaticus*) near Oxford. Some of these were provisionally determined as *C. pusilla*, and have been recorded as such, by the writer (1926). Further study, however, shows that this determination was erroneous, and that the species found in the wood-mouse is not *C. pusilla*, but in all probability *C. lobata*. In view of the fact that the type-specimen of *C. lobata* was poorly preserved, such slight discrepancies as exist between Baer's description and the appearance of the present material may be attributed to differences in fixation and in state of contraction. One such apparent difference is that in the

wood-mouse specimens the mature segments (fig. 1) are usually much shorter in proportion to their width than is indicated in Baer's figure.

Baer has pointed out that the excretory system of *C. lobata* differs profoundly from that of *C. pusilla* and *C. dendritica*, in that it consists of a complex network with numerous anastomosing longitudinal canals. This character may also be observed in preparations of the specimens from the wood-mouse. The number of testes in each segment appears to be about the same (200) as in Baer's specimen, while they extend forward at the sides of the segment to the level of the anterior border of the vitelline gland, as in his figure, instead of being confined to the posterior half of the segment, as in

Fig. 1.



Mature segment of *Catenotænia lobata* from *Apodemus sylvaticus* (semi-diagrammatic).

c., cirrus; *c.s.*, cirrus-sac; *ov.*, ovary; *r.s.*, receptaculum seminis; *s.*, shell-gland; *t.*, *t.*, testes; *v.*, vagina; *v.d.*, vas deferens; *vit.*, vitelline gland.

C. pusilla. The genital pore is situated, as in Baer's specimen, very near to the anterior corner of the segment, and not, as in *C. pusilla*, at about the anterior third of its length. A characteristic feature is that the segments are without prominent posterior angles, and scarcely overlap at all, so that the lateral borders of the strobila appear almost uninterrupted. The individual segments tend to be slightly wider at their anterior than at their posterior borders, while the greatest width is at the level of the prominent genital pore.

Specimens with gravid segments vary very greatly in size. An individual of about 12 mm. in length and a little over 1 mm. in maximum width, in which some 30 segments could

be counted, proved to have a well-developed uterus in the posterior segments; while the largest specimen measured was about 144 mm. long and 2·5 mm. in maximum width when mounted in Canada balsam, and had about 75 segments, of which the last 45 contained a uterus. The uterus is of the same type as in *C. pusilla* and *C. dendritica*, with a median longitudinal stem and numerous lateral branches. When fully developed it has about twenty main branches on each side, each of which gives rise to a number of secondary branches both laterally and terminally. The segments appear to be lost before the eggs reach their full development.

4. *Catenotænia symmetrica*, sp. n. (Fig. 2.)

The writer received some time ago, through the kindness of Dr. G. A. K. Marshall, C.M.G., F.R.S., Director of the Imperial Bureau of Entomology, some specimens of a Cestode collected from the small intestine of a black rat (*Rattus rattus*) at Lyallpur, Punjab, India. On examination these proved to represent a species of *Catenotænia*, but evidently not *C. pusilla*. The present opportunity is therefore taken of describing the species, which differs in several particulars from those which have already been mentioned.

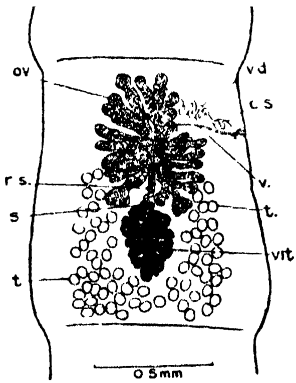
The length of the largest fragment (of which the scolex and probably a considerable number of anterior segments are missing) is about 130 mm., and its maximum width about 2 mm. In other specimens the scolex is about 0·42 mm. in width and the suckers 0·15 mm. in diameter. There is no rostellum. There is no sign of segmentation for about the anterior 4 mm. The anterior segments are rather wider than long. The earliest mature segments are more or less square, measuring 0·9–1·0 mm. in both directions. Older segments become longer, until the posterior gravid segments are nearly twice as long as broad. Each segment increases in width posteriorly, but narrows again rather suddenly just before its junction with the succeeding segment, forming rounded angles laterally. There is no overlapping at the posterior margin. The genital pores are irregularly alternating and situated near the anterior end of the segment, but not prominent as in *C. lobata*.

The dorsal excretory canals are narrow and unbranched, and are situated laterally to the main ventral canals, which give rise to a branching system of vessels as in *C. lobata*.

The cirrus-sac is pear-shaped or oval, and measures about 0·125 mm. × 0·065 mm. The vas deferens is wide and considerably coiled. The vagina expands only at its inner end,

between the ovary and yolk-gland, into an elongate receptaculum seminis. The ovary is deeply lobed, and occupies the median field of the anterior half of the segment. Its lobes do not extend posteriorly beyond the anterior margin of the vitelline gland. This organ is also almost exactly median, and not markedly displaced towards the pore side of the segment, as is the case in other species of the genus. There are about fifty to seventy-five testes in each segment, arranged for the most part in a single layer. Laterally they extend forward well in front of the vitelline gland.

It appears doubtful whether there is at any stage a uterus



Mature segment of *Catenotænia symmetrica* (semi-diagrammatic).

Lettering as in fig. 1.

with definite walls. If so, it breaks down almost immediately, and the ova become distiibuted evenly throughout the parenchyme.

The eggs are much larger than those of the other species for which they have been described. Eggs taken from the oldest segments, in which a thick outer shell has been developed, show the following measurements :—outer shell 0·06–0·0625 × 0·0525–0·055 mm.; inner shell 0·035–0·04 × 0·03–0·035 mm. The embryo almost completely fills the inner shell, and has hooks measuring about 0·015 mm. in length.

The accompanying table (p. 438) gives some of the more important distinguishing characters of the four species of the genus. All the measurements are in millimetres.

Species	*pusilla.*	*dendritica.*	*lobata.*	*symmetrica.*
Description by	Janicki, 1906.	Riggenbach, 1895.	Baer, 1925.	Baylis (present paper).
Length	60–80	100–150	28 *	130 and over.
Maximum width	....	1·5	1·5 *	2·0
Diameter of scolex	0·3	0·29	0·7	0·42
„ suckers	0·088	....	0·2	0·15
Excretory system	Not a network.	Not a network.	A network.	A network.
Genital pores	In front of middle of segment.	At about anterior third of segment.	Near anterior border of segment.	Near anterior border of segment.
Cirrus-sac, dimensions	0·214 × ?	....	0·15 × 0·06	0·125 × 0·065
Testes, approximate number	70	200–250	200	50–75
„ arrangement	Confined to posterior half of segment, in 2–3 layers.	Mainly lateral, in posterior half of segment. 3–4 layers.	Mainly posterior, but extending forward laterally to anterior limit of vitelline gland, in 2–3 layers.	Mainly lateral, extending forward beyond anterior limit of vitelline gland, mainly in a single layer.
Ovary, form and extent	Rather solid, extending right across anterior half of segment, and not extending behind vitelline gland.	Deeply lobed, extending posteriorly to about middle of vitelline gland.	Fan-like, deeply lobed, extending posteriorly beyond, and embracing, vitelline gland.	Deeply lobed, almost median, not extending posteriorly beyond anterior limit of vitelline gland.
Vitelline gland	Not deeply lobed, transversely elongated, poral.	Deeply lobed, all lobes posterior, poral.	Deeply lobed, all lobes posterior, poral.	Moderately deeply lobed, median.
Uterus	Figured with 9–13 main branches on each side.	Figured with 15–16 main branches on each side.	.... . [See present account.]	No definite uterus observed. Eggs in parenchyme.
Eggs: maximum diam. of Outer shell	0·029	0·022	......	0·06–0·0625
Inner shell	0·018	....	....	0·035–0·04

* The writer's specimens attain a length of 144 mm. and a width of 2·5 mm.

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XLIII.—*A Comparative Study of the Otoliths of the Neopterygian Fishes* (continued).—*Orders Allotriognathi, Berycomorphi, Zeomorphi.* By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plate VIII.]

XIV. Order ALLOTRIOGNATHI.

The otoliths of *Lampris luna* (fam. Lampridæ) were obtained from a fish weighing 95 lbs. and are very small relatively to the size of the specimen. The sagitta (Pl. VIII. fig. 14) is aberrant in shape, extremely frail, and strongly curved—the outer side is concave, and the inner side convex. The dorsal rim is concave and provided with a high irregular process anteriorly inclined; the ventral rim is divided by a rectangular indentation, the hinder part is rounded and passes into the posterior rim, and the anterior part is curved; anteriorly there is a broad pointed rostrum, inclined outwards; the posterior rim is rounded and forms an angle with the dorsal rim. The sulcus, which is divided by a wide rectangular crest surrounding the indentation of the ventral rim, occupies the surface of the rostrum and has a short crest below the hinder part of the ostium; the cauda is deep and circular, and is surrounded by a margin which joins the ventral crest. The asteriscus (Pl. VIII. fig. 15) is very frail, and is as high as the sagitta; it is broad ventrally and beak-shaped dorsally; an arrowhead-shaped anterior process is present, attached by a slender connection. The lapillus (Pl. VIII. fig. 16) is a third of the height of the asteriscus; it is stouter than the other otoliths and is conchoidal in shape, with extended wings.

In comparing the otoliths of *Velifer hypselopterus* with those of *Lampris*, the lapillus (Pl. VIII. fig. 19) is of the same conchoidal type, and the asteriscus (Pl. VIII. fig. 18) similar in general aspect but narrower ventrally. The sagitta (Pl. VIII. fig. 17) differs from that of *Lampris*, being less aberrant; the shape is ovate; the outer side is concave and the inner side is convex; the dorsal rim is domed and is truncated anteriorly, being two-thirds the length of the otolith. The ventral rim is irregularly curved; the anterior rim is irregular, the lower part consists of a blunt rostrum and the upper part of the frontal edge of the ostium; there is no antirostrum or excisura. All the rims are serrated. The sulcus opens widely on the upper part of the anterior rim and is divided by an angle of the lower margin, the ostium is open on its dorsal margin; the cauda is wide and curved, the end is rounded and does not approach the posterior or ventral rims.

In *Trachypterus tænia*, of the family Trachypteridæ, the otoliths are microscopic, and in an example 18 inches in length only the sagitta (Pl. VIII. fig. 10) was discernible, this measuring less than 1 mm. in length and height. It resembles that of *Velifer* in the truncated dorsal area, which, however, is higher, and in the absence of an antirostrum and excisura. The dorsal rim is high and forms an angle with the anterior rim, the ventral rim has a median angle, the posterior rim is obtusely angular, and the anterior rim oblique. The sulcus opens widely on the anterior rim above the rostrum. There is an angle of the upper margin, but none on the lower. The ostium is widely distended superiorly, and is longer than the cauda, which is short and ill-defined.

XV. Order BERYCOMORPHI.

In his classification of this order Mr. Tate Regan * draws attention to the fact that, although these fishes approach the Percoids in their general structure, they also retain many features which indicate their relationship to primitive Clupeoids. In the otoliths this duo-relationship is best seen in the Holocentridæ, in which the general form of the sagitta is similar to that of *Elops*, but the sulcus is distinctly Percoid in character, and the posterior rim is also modified.

In *Polymixia japonica*, of the family Polymixiidæ, the most

* Ann. & Mag. Nat. Hist. ser. 8, vol. vii. p. 1 (1911).

primitive and typical form of the Berycoid fishes, the sagitta is roughly circular and plate-like, the outer side being flat and hollowed medianly, the inner side convex. The dorsal rim is high, serrated, and with a median angle ; the ventral rim is deeply keeled anteriorly, giving rise to a type that may be described as "Berycid." In *Polymixia* it is without serrations, and posteriorly it is slightly concave passing into the posterior rim, which consists of two rounded prominences with an indentation between. The lower part of the anterior rim is curved and regular, passing into the ventral rim; the upper part contains a slight rostrum and antirostrum with excisura, the ostial floor bulging between them. The sulcus, which is divided and has upper and lower angles, opens widely on the upper part of the anterior rim; the ostium is ovate, and the upper and lower margins are equally distended ; the cauda is straight medianly, the end is curved and pointed, and terminates above the ventral rim.

In *Beryx splendens* (of the family Berycidæ), the sagitta (Pl. VIII. fig. 2) resembles that of *Polymixia* in the distinctive shape of the ventral rim, but differs in the serrated edge. It differs in the anterior rim, which is produced upwardly, until the rostrum is level with the dorsal rim, which is lower and straighter than in *Polymixia*. The sulcus opens on the dorsal rim, and also differs in the length and ventral distension of the ostium ; the cauda is shorter than the ostium and wider than in *Polymixia*, from which it differs in the absence of the terminal curve, becoming shallow and opening on the posterior rim.

In *Hoplostethus mediterraneus*, of the family Trachyidæ, the sagitta (Pl. VIII. fig. 3) resembles that of *Beryx* in the dorsal and anterior rims, also in the sulcus which opens on the dorsal rim. It differs in the ostium slightly, which is more perpendicular and does not exceed the cauda in length, it is distended ventrally, and there is a prominent angle between it and the cauda, which is shallow, distended ventrally, and disappears before reaching the posterior rim. It also differs in the posterior rim which is doubly furcated, and in the ventral rim which is only slightly keeled anteriorly, and has an angular process near its median part. This otolith shows an extraordinary resemblance to that of *Neoscopelus* of the order Iniomi.

The sagitta of *Monocentris japonicus* (Pl. VIII. fig. 4), of the family Monocentridæ, resembles that of *Polymixia* in the depth of the ventral rim. It differs in the irregular dorsal rim and in the presence of a præsulcal area enclosing the ostium, which is distended ventrally and is somewhat

rectangular in shape. The cauda is irregular, shorter than the ostium, and does not reach the posterior rim, which is oblique and extended dorsally.

In *Holocentrum rubrum*, of the family Holocentridæ, the sagitta (Pl. VIII. fig. 5) resembles that of *Polymixia* in the sulcus, in which the ostium is distended ventrally, though not dorsally as in *Polymixia*, and is shorter than the curved cauda. It differs in the shape of the otolith, which is elongated and Elopine in type. The outer side is concave and the inner side is convex. The dorsal rim is low, slightly curved, and highest posteriorly, the ventral rim is slightly keeled and has a median angle, the posterior rim is oblique and irregular, with upper and lower processes. The anterior rim consists of a blunt rostrum with a narrow præsulcal area. The sulcus opens on the upper margin of the rostrum, and has a strong angle of the lower margin; the cauda is longer than the ostium and is strongly curved, it ends above the ventral rim.

The sagitta of *Holocentrum sammara* (Pl. VIII. fig. 6) resembles that of *H. rubrum*; it differs in the dorsal rim which posteriorly is downwardly inclined, in the shorter posterior rim in which the processes are in close approximation, in the slight serrations of the ventral rim, and in the slighter curve of the cauda.

The sagitta of *Myripristis murdjan* (Pl. VIII. fig. 7), also of the family Holocentridæ, resembles *Polymixia* in the depth of the ventral rim, but otherwise presents several aberrant features. The dorsal rim is very low and the dorsal area wedge-shaped, and highest posteriorly; the ventral rim is deep anteriorly, the posterior part sloping upwards to the level of the cauda, but without the slight concavity showing in this part in *Polymixia* and *Beryx*. The anterior rim consists of an antero-dorsal rectangular projection, of which the lower margin is oblique, and the upper margin at right angles to it. The posterior rim is small, irregular, and concave. The sulcus extends across the otolith; the ostium covers the anterior projection except for a very narrow crest on the ventral edge; it is flush with the rest of the otolith, and projects posteriorly above and below the cauda, which is deep and irregular, and about three times the length of the ostium; it projects into the ostial area, and opens widely on the posterior rim.

Fossil otoliths of *Hoplostethus* have been figured by Koken* from the Pliocene of Italy, and from the Middle Oligocene of

* Zeit. d. deut. geol. Gessel. Bd. 43, taf. ix., Berlin (1891).

Germany, the latter occurring with other forms described as "Berycidarum." Otoliths of *Myripristis* occur frequently in the Upper Eocene of Barton, Hampshire, and have been figured by Schubert *, who ascribed them to the family Sciænidæ, in which the peculiar flush ostium is also present. The error was pointed out later by C. E. Shepherd †.

XVI. Order ZEOMORPHI.

In the two genera of the order Zeomorphi here described —*Zeus* and *Capros*—the sagitta is highly aberrant, though resembling in the depth of the ventral rim the otoliths of the order Berycomorphi, in which, according to Mr. Tate Regan ‡, they are related.

In *Zeus faber*, of the family Zeidæ, the sagitta (Pl. VIII. fig. 8) is small, flat, and unique in shape. It resembles an inverted trefoil, with the addition of lateral pointed processes between the lobes. The dorsal rim has a median depression, on each side of which the dorsal area is extended, forming two wing-like processes. Below these a transverse bar, thickened and raised medianly, and with pointed extensions half the length of the dorsal processes, extends across the otolith. Between the upper and lower projections on each side a deep excisura is present. Below the transverse bar the otolith is constricted and flat, widening to the ventral rim. There is no sulcus. The asteriscus (Pl. VIII. fig. 9) is microscopic, the ventral part is wide, and the dorsal part curved forward and pointed. The lapillus (Pl. VIII. fig. 9), also diminutive, is elongated and deepest anteriorly.

In *Capros aper*, of the family Caproidæ, the sagitta (Pl. VIII. fig. 11) resembles that of *Zeus* in many features, but is perhaps less aberrant. In the specimen examined the two sagittæ differ in their proportions, and the right otolith has been selected for description. The shape is irregular and the otolith is thick and deep. The outer side is flat and the inner side convex. The dorsal rim has a deep irregular median excision corresponding to the more symmetrical depression in *Zeus*, and has also the lateral excisuræ below the dorsal area; the two divisions of the upper part are higher and less wing-like than in *Zeus*, and the excisuræ

* Jahrb. der k.-k. geol. Reichsanst. lxx. taf. vii. fig. 16, Wien (1915).
† Bull. Soc. géol. de France, ser. 4, xxii. p. 140 (1922).
‡ Ann. & Mag. Nat. Hist. ser. 8, vol. vi. p. 428 (1910).

are connected by a straight deep sulcus. The anterior excisura is wider than the posterior, and a rostrum and antirostrum are present on the anterior rim. Below the sulcus there is a raised portion corresponding with the transverse bar extending across the otolith in *Zeus*—this forms a pointed process on the posterior rim, but not anteriorly. The ventral area is deep and constricted as in *Zeus* on the posterior side, but anteriorly the ventral rim is curved and filled out as in the deeper otoliths of the Berycomorphi. The asteriscus (Pl. VIII. fig. 12) resembles that of *Zeus*, but it is flatter and less microscopic. The lapillus (Pl. VIII. fig. 13) is thick and conchoidal in shape, and larger than in *Zeus*.

Summary.

1. In the order Allotriognathi, the sagitta and asteriscus of *Lampris* are highly specialized, the latter being noticeable for its great size.

In *Velifer* the asteriscus, though smaller, resembles that of *Lampris*, and the lapilli in the two genera are of the same conchoidal shape, the sagitta is more generalised and resembles that of *Polymixia* of the order Berycomorphi, but differs in the truncation of the dorsal area and in the straightness of the ventral rim.

In *Trachypterus* the sagitta resembles that of *Velifer*; it differs in the sulcus and in the greater height of the dorsal rim.

2. In the order Berycomorphi a form of sagitta distinguished by the depth of the anterior part of the ventral rim may be described as the "Berycid" type. The ostium is larger and broader than the cauda in those genera in which the sulcus opens on the dorsal rim or is entirely enclosed—e. g., *Beryx*, *Monocentris*, etc.,—and is shorter and with a curved cauda in those where it opens on the anterior rim—e. g., *Polymixia*, *Holocentrum*, etc. Fossil forms of the otoliths of Berycoids have been described from the Pliocene, Oligocene, and Eocene.

3. In the order Zeomorphi the sagitta is highly specialized, but resembles the "Berycid" type in the depth of the ventral rim.

4. The evidence of the otoliths strongly supports the conclusion that the orders Allotriognathi and Zeomorphi, as established by Mr. Regan, are natural groups.

EXPLANATION OF PLATE VIII.

Fig. 1. *Polymixia japonica*, 1×2.
Fig. 2. *Beryx splendens*, 1×1.
Fig. 3. *Hoplostethus mediterraneus*, 1×1¼.
Fig. 4. *Monocentris japonicus*, 1×1½.
Fig. 5. *Holocentrum rubrum*, 1×2.
Fig. 6. —— *sammara*, 1×3.
Fig. 7. *Myripristis murdjan*, 1×1½.
Fig. 8. *Zeus faber* (sagitta), 1×4.
Fig. 9. —— —— (asteriscus and lapillus), 1×5.
Fig. 10. *Trachypterus tænia* (sagitta), 1×8.
Fig. 11. *Capros aper* (sagitta), 1×3.
Fig. 12. —— —— (asteriscus), 1×3.
Fig. 13. —— —— (lapillus), 1×3.
Fig. 14. *Lampris luna* (sagitta), 1×2.
Fig. 15. —— —— (asteriscus), 1×2.
Fig. 16. —— —— (lapillus), 1×4.
Fig. 17. *Velifer hypselopterus* (sagitta), 1×2½.
Fig. 18. —— —— (asteriscus), 1×3.
Fig. 19. —— —— (lapillus), 1×3.

XLIV.—*Neuroptera*: Chrysopidæ *of the Seychelles and adjacent Islands.* By P. ESBEN-PETERSEN (Silkeborg, Denmark). *With an Introductory Note by* HUGH SCOTT.

[Plates IX.-XI.]

[INTRODUCTORY NOTE.

With the publication of this report on the CHRYSOPIDÆ, the working out of the Neuroptera collected by the Percy Sladen Trust Expedition in the Seychelles and other islands of the Western Indian Ocean in 1905 and 1908–1909 is finished. The material on which this paper is based was for many years in the hands of other specialists, who were, however, unable to complete a study of it; and thanks are due to Mr. Esben-Petersen for bringing his extensive knowledge of Neuropterous insects to bear on these specimens, and so carrying the matter to a conclusion.

A first set of the material, including the TYPES of the new species, will be placed in the British Museum; other examples are retained in the Cambridge Museum and in Mr. Esben-Petersen's collection.

The author has allowed me to draw up the lists of localities where the specimens were taken. Records from the Seychelles, in 1908 or 1909, to which no collector's name is added, refer

to specimens collected by myself or Mr. H. P. Thomasset. In other cases the collector's name is given. This paper also includes a record of the CHRYSOPIDÆ obtained in Rodriguez by Mr. Thomasset and Mr. H. J. Snell in 1918; these all belong to one species—*Ch. flavostigma*, sp. n.

My recollections and notes testify to the fact that, in the Seychelles, this group was not associated specially with the endemic forests at high elevations. Some of the specimens certainly were obtained in these forests, including one example of *Ch. litorosa* from the highest and dampest forest of Silhouette. But the species found in the forests were obtained at lower elevations as well. Some of the species, at any rate, were associated particularly with the foliage of large shade-giving trees, not always of endemic species, in and about cultivated places. For instance, seventeen examples of *Ch. litorosa*, together with specimens of two other species, were taken in the little coconut-planted islet called Long Island, close to Port Victoria, Mahé. Moreover, out of the eight species only four were found exclusively in the Seychelles, three others were obtained both in the Seychelles and in certain of the groups of low-lying coral islands visited by the Expedition, while one (*Ch. rutila*, sp. n.) was taken only in the coralline islands of the Chagos group. On the whole, these facts do not point to the green lacewings forming part of the ancient endemic fauna of the granitic mountains of the Seychelles.—H. S.]

At present the following species of CHRYSOPIDÆ are known from Madagascar and the small islands of the Western Indian Ocean:—

OLIGOCHRYSA, Esb.-Pet.

Oligochrysa voeltzkowi (*Leucochrysa*), v. d. Weele, Bull. scient. France et Belgique, p. 67, pl. ii. fig. 4 (1908)—Comoro Islands.

This genus is for the rest only known from Australia.

ANCYLOPTERYX, Brauer.

Ancylopteryx alluaudi, Navás, Broteria, p. 50, fig. 8 (1910)—Seychelles Islands.

NOTHOCHRYSA, MacLachl.

Nothochrysa variegata (*Chrysopa*), Burmeister, Handbuch, p. 981 (1839)—Comoro Islands.

Syn. *Nothochrysa sordidata*, Navás, Mem. Real. Acad. Barc. p. 404, fig. 5 (1908)—Madagascar.

NESOCHRYSA, Navás.

Nesochrysa grandidieri, Navás, Broteria, p. 53, fig. 10 (1910) —Madagascar.

LEUCOCHRYSA, MacLachl.

Leucochrysa marginata, Navás, Broteria, p. 100, fig. 1 (1912) —Madagascar.

CHRYSOPA, Leach.

Chrysopa mauricianus, Rambur, Névioptères, p. 425 (1842) —Mauritius; MacLachlan, Trans. Ent. Soc. Lond. p. 201 (1868).

Chrysopa brevicollis, Rambur, Névioptères, p. 427 (1842)— Mauritius; Schneider, Symbolæ etc. p. 93, tab. xxiv. (1851).

Chrysopa eurydera, Navás, Broteria, p. 43 (1910)—Madagascar.

Chrysopa ceratina, Navás, Broteria, p. 44 (1910)—Mozambique.

Syn. *Chrysopa inæqualis*, Navás, Broteria, p. 103 (1912)—Madagascar.

Chrysopa desjardinsi, Navás, Ann. Soc. scient. Brux. p. 4 (1911)—Mauritius.

Chrysopa nesaea, Navás, ibid. p. 5 (1911)—Mauritius.

Chrysopa litorosa, Navás, ibid. p. 6 (1911)—Seychelles.

Syn. *Chrysopa meriani*, Navás, Public. Acad. Cienc. Zarag. p. 22 (1924) —Seychelles.

Chrysopa madegassa, Navás, Revista Acad. Cienc. Zarag. p. 69 (1921)—Madagascar.

In this paper descriptions are given of five more new species belonging to the genus *Chrysopa*.

It seems to me that the Chrysopid fauna of these islands has only little to do with that of the African continent. The only species which I find to be common to both are *Nothochrysa variegata*, Burm., which is known from East Africa (from Abyssinia to Natal), the Comoro Islands, and Madagascar, and *Chrysopa ceratina*, Navás, known from Mozambique and Madagascar.

1. *Ancylopteryx alluaudi*, Navás, Broteria, p. 50, fig. 8 (1910) —Seychelles, Mahé. (Pl. IX. figs. 1, 2.)

This species seems to be very variable. Amongst the eleven specimens before me only one example agrees fairly as to the markings of the wings with the original description. All the other specimens lack those markings more or less, although they correspond closely with the original in other respects.

Here I should like to repeat what I have already remarked on several occasions, that some authors in their descriptions ascribe too much importance to the colouring of specimens (especially in the CHRYSOPIDÆ). Very often marks on wings and body are present or absent, as the case may be, merely owing to the degree of maturity, and there are few insects in which colour is so apt to fade or change after death as in the Neuroptera. It is, then, evident that the use of the colours as the only specific characters in descriptions of CHRYSOPIDÆ may easily cause great mistakes, and I am sure that large numbers of species of CHRYSOPIDÆ standing in our lists are only synonyms.

Loc. Seychelles, Mahé: Forêt Noire district, about 800 feet, x.–xi. 1908, 8 examples (including the two varieties photographed); Cascade Estate, about 800 feet, between x. 1908 and i. 1909, 1 specimen; Mare aux Cochons district, about 1500 feet, 26. i.–2. ii. 1909, 1 specimen; 1905, 1 example without further data (*Gardiner*).

2. *Chrysopa litorosa*, Navás, Ann. Soc. scient. Brux. p. 6 (1911)—Seychelles, Mahé. (Pl. IX. fig. 3.)

Chrysopa meriani, Navás, Public. Acad. Cienc. Zarag. p. 22 (1924)—Mahé.

This species is quite immaculate yellowish-green. Venation greenish. In the fore wing 5 cross-veins between *Rs* and *Psm*; 8 (seldom 9) branches from *Rs* to apical margin of wing. Basal cell in fork of *M* rather oblong. Gradate cross-veins placed in two straight, regular and parallel series; inner series abbreviate at its apical end; 4–6 cross-veins in inner series, 8–10 in outer series. In hind wing 4 cross-veins between *Rs* and *Psm*; 7 (seldom 8) branches from *Rs*. Gradate cross-veins placed as in the fore wings; 4–5 in inner series, 7–8 in outer series.

Length of fore wing 12–14·5 mm.; that of hind wing 11–12 mm.

Loc. Seychelles and Amirantes.

Seychelles: Silhouette, Mahé, Long I., Praslin, Marie Anne, Dennis I. Silhouette: plateau of Mare aux Cochons and forest above, over 1000 feet, ix. 1908, 7 examples; highest forest near Mont Pot-à-eau, about 2000 feet, 1 example. Mahé: Cascade Estate, between 800 and 1500 feet, x. 1908–ii. 1909, 2 specimens; Forêt Noire district, about 800 feet, x.–xi. 1908, 4 specimens. Long Island (a small coconut-planted islet off Mahé), vii. 1908, 17 examples. Praslin: 1 example, 1905 (*Gardiner*). Marie Anne Island: from forest of a dry type, 3. xii. 1908, 3 specimens. Dennis Island: viii. 1908, 2 examples (*Fryer*).

Amirantes: Poivre I., 1905, 5 examples (*Gardiner*).

The series numbers over forty specimens, and these were taken in all kinds of localities—in low-lying coral islands (Amirantes and Dennis I.) and, in the Seychelles proper, from almost sea-level in Long and Marie Anne Islands up to the highest and dampest zone of forest in Silhouette.

The type-specimen of *Ch. litorosa*, Navás, is in the Paris Museum, while that of *Ch. meriani*, Navás, is in the Berlin Museum, and both were collected in Mahé. At the end of the description of *Ch. meriani* Navás remarks that no other species of *Chrysopa* is known from the Seychelles. It is rather characteristic that Navás in 1924 did not remember that he in 1911 had seen the same species from the same locality, and described it under another name.

3. *Chrysopa scotti*, sp. n. (Pl. X. fig. 4.)

Large; yellowish-green. Head, palpi, and antennæ yellowish. Antennæ longer than fore wing, becoming brownish towards apex. Prothorax yellowish, a little longer than broad; front angles truncate. Meso- and metathorax yellowish. Abdomen somewhat brownish. Legs pale yellowish; claws with a broad tooth at the base. Fore wings rather broad and with rounded apex; hind wings narrower and with more acute apex. Pterostigma yellowish, long and opaque. Venation yellowish; all the veins bearing short yellowish hairs. In the fore wings the first cross-vein from *Rs* touches *Psm* within the basal cell of the fork of *M*; 6 cross-veins between *Rs* and *Psm*; 9 branches from *Rs*. Outer series of gradate cross-veins regularly placed and parallel to the margin of the wing and to the inner series. The distance between the outer series and the margin of the wing is equal to that between the inner and the outer series. Inner series also regularly placed, but its apical end nearer to *Rs* than its basal end. 8–9 gradate cross-veins in inner

series; 9–10 in outer series. In hind wing 5 cross-veins betweeen *Rs* and *Psm*; 8 branches from *Rs*. The two series of gradate cross-veins are placed as in the fore wing; 8 gradate cross-veins in inner series, 9 in outer.

Length of fore wing 18–20 mm.; that of hind wing 16–17 mm.

Loc. Seychelles, Mahé: Forêt Noire district, about 800 feet, x.–xi. 1908, 3 specimens.

I take the liberty to name this large and fine species in honour of its collector.

The species is very like *Ch. litorosa*, Navás; it is, however, larger, the basal cell in the fork of *M* is relatively broader, and the arrangement of the gradate cross-veins is different in the two species.

4. *Chrysopa ictericus*, sp. n. (Pl. X. fig. 5.)

Yellowish-green, immaculate. Sometimes there is a trace of a reddish mark below the eyes. Antennæ as long as the fore wing, yellowish, becoming brownish towards the apex. Prothorax a little broader than long, front angles rounded. Thorax and abdomen greenish-yellow. Legs pale; claws with a broad tooth at the base internally. Wings acute at apex, hind wings narrower than fore wings and more pointed at apex. Venation rather yellowish, and the veins with yellowish hairs. Pterostigma strongly greenish-yellow, rather opaque in hind wing. In fore wing 5 cross-veins between *Rs* and *Psm*; 6–8 branches from *Rs* to apical margin of the wing; these branches rather nearly straight. The outer row of gradate cross-veins very regular and straight; the inner row closer to the outer row than to *Rs*; the basal cross-vein of the inner series is placed basad the direction of the others. First cross-vein between *Rs* and *Psm* touching *Psm* within the basal cell in the fork of *M*. 4–7 gradate cross-veins in inner series, 6–8 in outer series. In matured specimens the basal part of Cu_2, the basal cross-vein in the cubital fork, and the gradate cross-veins are faintly brownish. In hind wing 4 cross-veins between *Rs* and *Psm*; 5–7 branches from *Rs* to margin of wing. Gradate cross-veins placed as in fore wing, but hardly darker than the other veins; 3–5 gradate cross-veins in inner series, 5–7 in outer series.

Length of fore wing 12–13 mm.; that of hind wing, 11–11·5 mm.

Loc. Seychelles, Amirantes, Aldabra.

Seychelles: Silhouette, Mahé, Praslin. Silhouette: plateau of Mare aux Cochons, over 1000 feet, ix. 1908, 11 specimens. Mahé: Forêt Noire district, about 800 feet, x.–xi. 1908, 4 examples. Praslin: 1905, 2 examples (*Gardiner*).

Amirantes: d'Arros I., 12. x. 1905, 1 specimen (*Gardiner*).

Aldabra: 1908–9, 6 examples (*Fryer*).

The specimen from the Amirantes is badly preserved and rather discoloured, and is therefore referred to this species with some hesitation.

5. *Chrysopa flavostigma*, sp. n. (Pl. X. fig. 6.)

Flavous and immaculate. Antennæ longer than fore wings, yellowish, becoming brownish towards apex. Prothorax broader than long, front angles truncate. Thorax and abdomen yellowish-green, with a yellowish longitudinal median streak. Legs pale yellowish-green. Claws with a broad tooth at the base internally. Wings rather broad and obtusely pointed at apex. Venation greenish-yellow. Pterostigma flavous, rather conspicuous and opaque in hind wings. In fore wings 5 cross-veins between *Rs* and *Psm*; 6–8 branches from *Rs*. Basal cross-vein between *Rs* and *Psm* touching the basal cell in the fork of *M* at its apex. The two rows of gradate cross-veins regularly placed; 5–8 in inner series and 6–9 in outer series. In hind wings 4 cross-veins between *Rs* and *Psm*; 6–7 branches from *Rs*. The two series of gradate cross-veins regularly placed as in the fore wings; 4–5 in inner series and 6–8 in outer series.

Length of fore wing 10–12·5 mm.; that of hind wing 9–11·5 mm.

Loc. Seychelles, Coetivy, Aldabra, Rodriguez.

Seychelles: Long I., Praslin, Dennis I. Long Island: vii. 1908, 2 examples. Praslin: 1905, 1 example (*Gardiner*). Dennis Island: viii. 1908, 1 specimen (*Fryer*).

Coetivy: 1905, 6 examples, including two dated respectively 10. ix. and 24. ix. (*Gardiner*).

Aldabra: 1908–9, 1 example (*Fryer*).

Rodriguez: viii.–xi. 1918, 3 examples (*Thomasset and Snell*).

This species is evidently widely spread in the various groups of islands in the region under review. It was not found in the endemic mountain-forests of the Seychelles.

6. *Chrysopa lauta*, sp. n. (Pl. XI. fig. 7.)

A small and pretty species. Labial palpi black, with pale articulations. Clypeus brownish-red, with a red mark at the

lateral margins. Face and vertex strongly yellowish; below each antenna a transversely placed, strongly red streak; in front of the vertex and above the antennæ a strongly red V-shaped figure. Antennæ longer than fore wings, yellowish at base and becoming brownish towards apex. Prothorax broader than long, yellowish and with narrow red lateral margins; meso- and metathorax yellowish, with yellowish-brown lateral margins. Abdomen yellowish; pleuræ reddish (in the two dried specimens before me). Legs pale. Claws small and with a broad tooth at the base. Wings elongate, hind wings narrower than fore wings and more acute at apex. Venation pale greenish-yellow; veins strongly greenish haired. Pterostigma yellowish, opaque. In the fore wing first and second cross-vein in the cubital fork somewhat darker than the other cross-veins; 5 cross-veins between *Rs* and *Psm*; 5 branches from *Rs*. First cross-vein from *Rs* touching *Psm* at the tip of the basal cell of the median fork; this cell is rather elongate. The two series of gradate cross-veins regularly placed; the series are parallel to each other and to the margin of the wing. In inner series 3–4 cross-veins, in outer series 5. In hind wing 4 cross-veins between *Rs* and *Psm*, and 4–5 branches from *Rs*; 1–2 gradate cross-veins in inner series, 4 in outer series.

Length of fore wing 10–11 mm.; that of hind wing 9–10 mm.

Loc. Seychelles: Mahé, Long I. Mahé: Cascade Estate, 800 feet or over, between x. 1908 and i. 1909, 1 example. Long Island: vii. 1908, 1 example.

The two species last described belong to that group in which the first cross-vein from *Rs* in the fore wing touches *Psm* at the tip of the basal cell of the median fork, or outside that cell. Four species are already known from the South-western Indian Ocean and from South Africa, viz., *pudica*, Navás, from the Transvaal; *nesaea*, Navás, from Mauritius; *ceratina*, Navás, from Mozambique and Madagascar; and *brevicollis*, Rambur, from Mauritius.

7. *Chrysopa crassinervis*, sp. n. (Pl. XI. fig. 8.)

Greenish-yellow. Head yellowish, face tinged with red. Palpi yellowish. Antennæ a little longer than fore wings, yellowish, apical part somewhat darker. Thorax and abdomen brownish-yellow. Prothorax transverse. Legs yellowish; claws strongly broadened at base. Fore wings rather broad, subacute at apex; hind wings narrower and

more pointed at apex. Venation quite pale, with the exception of the inner cross-vein in the cubital fork and the cross-veins in the gradate series of the fore wings; these veins are dark. Pterostigma inconspicuous. In fore wing a part of *R* at the origin of *Rs*, basal part of *Rs*, fork of *M*, Cu_1 at its fork and a few cross-veins in the basal part of the wing, strongly thickened. In the hind wing no veins are thickened. In fore wing 5 cross-veins between *Rs* and *Psm*; the first cross-vein touches *Psm* within the basal cell of the fork of *M*; 6 branches from *Rs* to apical margin of wing; inner series of gradate cross-veins numbering 4–5, outer series 5–6; the series parallel to the hind margin and to *Rs*. In hind wing 4 cross-veins between *Rs* and *Psm*; 5–6 branches from *Rs*; 3–4 cross-veins in inner series, and 5–6 in outer series.

Length of fore wing 11 mm.; that of hind wing 10 mm.

Loc. Seychelles, Aldabra.

Seychelles: Silhouette, Mahé. Silhouette: plateau of Mare aux Cochons, over 1000 feet, ix. 1908, 6 specimens. Mahé: Forêt Noire district, about 800 feet, x.–xi. 1908, 1 example; Cascade Estate, 800 feet or over, between x. 1908 and i. 1909, 1 specimen.

Aldabra: 1908–9, 2 examples (*Fryer*).

This very interesting species occupies a peculiar position in the family CHRYSOPIDÆ, for, besides *Chrysopa crassoneura*, v. d. Weele, from Java and Sumatra, and *Ch. crassinervis*, I do not know any other species of *Chrysopa* with incrassate veins. In *Ch. crassoneura* only the gradate cross-veins in the outer series of the fore wing, together with the adjoining stems of the marginal forks, are thickened.

8. *Chrysopa rutila*, sp. n. (Pl. XI. fig. 9.)

Head yellowish-brown; palpi and antennæ yellowish-brown; antennæ longer than the fore wings. Prothorax pale brown, much broader than long. Meso- and metathorax and abdomen reddish-brown. Legs pale; claws with a very broad tooth at the base. Fore wings rather broad and broadly pointed at apex; costal area broad and of almost the same breadth throughout its whole length, pointed at the base and at the pterostigma; hind wings narrower and more pointed at apex. Venation yellowish with a brownish-red tinge. Pterostigma long; yellowish in the fore wings, brownish-red and very conspicuous in the hind wings. In fore wings 5 cross-veins between *Rs* and *Psm*, 7 branches from *Rs*; two subparallel series of gradate cross-veins, rather wide apart; 7 cross-veins in inner and 7 in outer

series. In hind wings 4 cross-veins between *Rs* and *Psm*, and 6 branches from *Rs*; the series of gradate cross-veins placed as in the fore wings, 5 in the inner and 5–6 in the outer series.

Length of fore wing 10–11·5 mm.; that of hind wing 9–10 mm.

Loc. Chagos Is.: Salomon Atoll, 1905, 4 specimens (*Gardiner*); Peros Banhos Atoll, 1905, 1 specimen (*Gardiner*).

This species is very like *Ch. olatatis*, Banks, from Australia, and *Ch. formosana*, E.-P., from Formosa and the Philippine Islands, especially with regard to the strongly coloured and very conspicuous pterostigma in the hind wings.

Below I give a table of all the known species of the genus *Chrysopa* from Madagascar and the islands of the Western Indian Ocean:—

1 *a*.	In the fore wing the first cross-vein from *Rs* to *Psm* touches *Psm* at the tip of the basal cell of the median fork, or outside that cell	2.
1 *b*.	In the fore wing the first cross-vein from *Rs* to *Psm* touches *Psm* within the basal cell of the median fork	6.
2 *a*.	Prothorax longer than broad	3.
2 *b*.	Prothorax broader than long	4.
3 *a*.	Venation and pterostigma yellowish. Wings elongate, apex acute. Gradate cross-veins 3/8 (3 in inner series, 8 in outer series), outer series black. In hind wing 3/7 gradate cross-veins. Fore wing 18 mm., hind wing 16 mm.	*ceratina*, Navás.
3 *b*.	Venation pale yellowish, pterostigma yellowish. Apex of fore wing subacute. Gradate cross-veins 4/6, outer series black, the adjacent marginal forks also black. In hind wing 3/7 gradate cross-veins. Fore wing 17 mm., hind wing 16 mm.	*nesaea*, Navás.
	[The last-named species is possibly the same as *ceratina*.]	
4 *a*.	Lateral margins of prothorax red or brownish-red. Palpi brownish or blackish. Head with spots	5.
4 *b*.	Prothorax without red or brownish-red lateral margins. Palpi yellowish. Head without spots	*flavostigma*, sp. n.
5 *a*.	In fore wing costal cross-veins blackish at that end which touches *Sc*. Head with a brown streak on the genæ	*brevicollis*, Ramb.
5 *b*.	Venation pale greenish-yellow. Genæ, face, and vertex with red markings	*lauta*, sp. n.
6 *a*.	In the basal half of the fore wings several longitudinal veins are incrassate	*crassinervis*, sp. n.

6 *b*.	No longitudinal veins are unusually thickened	7.
7 *a*.	Prothorax longer than broad	8.
7 *b*.	Prothorax broader than long	9.
8 *a*.	Large species. The two series of gradate cross-veins parallel to each other, complete and rather wide apart	*scotti*, sp. n.
8 *b*.	Smaller species. The two series of gradate cross-veins parallel; inner series shorter than outer series; the two series rather close together	*litorosa*, Navás.
9 *a*.	Head immaculate	10.
9 *b*.	Head with marks	13.
10 *a*.	Venation unicolorous; greenish or yellowish	11.
10 *b*.	Venation bicolorous; some cross-veins brown or blackish	12.
11 *a*.	Pterostigma hardly visible. Venation greenish	*desjardinsi*, Navás.
11 *b*.	Pterostigma, especially in the hind wings, very conspicuous. Venation yellowish ..	*rutila*, sp. n.
12 *a*.	Pterostigma elongate, yellowish, conspicuous. Venation pale. In the fore wings the radial cross-veins are black at the anterior end, gradate cross-veins black.	*erydera*, Navás.
12 *b*.	Pterostigma strongly greenish-yellow. Venation yellowish. In the fore wings one cross-vein near the base of the wing and all the gradate cross-veins are faintly brownish	*ictericus*, sp. n.
13 *a*.	Head with seven black spots; three at each side of face and one between the antennæ.	*mauricianus*, Ramb.
13 *b*.	Red streak on genæ, on margin of clypeus, on vertex and on occiput	*madegassa*, Navás.

EXPLANATION OF THE PLATES.

Plate IX.

Fig. 1. *Ancylopteryx alluaudi*, Navás, typical form.
Fig. 2. Ditto, variety with wing-markings reduced.
Fig. 3. *Chrysopa litorosa*, Navás.

Plate X.

Fig. 4. *Chrysopa scotti*, sp. n.
Fig. 5. —— *ictericus*, sp. n.
Fig. 6. —— *flavostigma*, sp. n.

Plate XI.

Fig. 7. *Chrysopa lauta*, sp. n.
Fig. 8. —— *crassinervis*, sp. n.
Fig. 9. —— *rutila*, sp. n.

XLV.—*Notes on the Coleopterous Genus* Sisyphus (Scarabæidæ). By Gilbert J. Arrow, F.Z.S.

[Plate XII.]

I published some notes on the strange spider-like beetles of this genus in Ann. & Mag. Nat. Hist. 1909 (vol. iii. p. 517 and vol. iv. p. 91). I have since been able to study types of most of the species, and am in a position to correct the rather numerous errors of nomenclature which have occurred in this very perplexing genus. For this opportunity I must express my gratitude to the various kind friends who have sent me for examination the types in their charge, viz., those of Fabricius, Olivier, Hope, and Gory, in the Oxford University Museum, sent me by Professor Poulton; of Klug, in the Berlin Museum, sent by Dr. Kuntzen; of Wiedemann, in the Hamburg Museum, by Herr Gebien; of Redtenbacher, in the Vienna Museum, by Dr. Holdhaus; and of Felsche, in the Dresden Museum, by Dr. Heller.

Partly owing to the fact that many of the species possess a special mechanism, in the shape of hooked spines, for covering themselves with dirt, the descriptions of the numerous forms of this peculiar genus are of an exceptionally unsatisfactory character, and the resulting confusion of their nomenclature has grown ever worse from the inability of the later describers, amongst whom I must include myself, to correctly interpret the work of their predecessors. The location of the original types of the earlier authors, and especially those of the bad descriptions and almost worse figures of the so-called 'Monographie' of Gory, published in 1833, has been unknown. The late Dr. Péringuey stated in his Catalogue of the Coleoptera of S. Africa (vol. xii. p. 897) that he had been able to examine some of Gory's types of *Sisyphus* in the Genoa Museum, but he was evidently mistaken. Gory's collection was dispersed, but Dr. Gestro informs me that no part of it is in the Genoa Museum. In Westwood's work on the genus *Bolboceras* in vol. xxi. of the Trans. Linn. Soc. he refers to some of those insects in the Hope Museum as formerly in the Gory collection, and most of the types of the *Sisyphus* "Monographie" evidently accompanied them, as I have been fortunate enough to discover.

These specimens, now in the Oxford University Museum, which Professor Poulton has kindly enabled me to study at

leisure in the British Museum, carry upon them no information except a small square of red paper with the letter G, but a label placed underneath each species bears data corresponding exactly with those contained in the 'Monographie.' These labels were no doubt provided either by Gory or Laferté, who seems to have been the first purchaser of Gory's collection. Gory's work enumerates twelve species, each represented by a figure and eight of them supposed to be described for the first time. Each of the twelve species is stated to be in his own collection, with one exception, *S. crispatus*, which is "du Cabinet de M. Chevrolat." In the Oxford Museum there are twelve corresponding labels and two bearing names not published by Gory. Each is placed behind specimens bearing the red G, with the single exception of *S. crispatus* (which Gory did not possess), of which there are specimens similarly pinned, but without the G. That the specimens bearing the red labels are the actual originals of the 'Monographie' seems to be established from a careful comparison with Gory's figures.

Of *S. capensis*, Gory, Péringuey has stated that it is no longer in the Gory collection, and he was not able to identify the species. Above the label bearing this name in the Oxford collection is a specimen of the European *Sisyphus schaefferi* bearing the red G. Gory's description compares *S. capensis* with that species, giving only a few slight differences of no value, and the figure is a crude representation of it.

The figure of *S. rugosus*, Gory, showing a tooth at the anterior edge of the middle femur, not mentioned in the description, has also puzzled Péringuey and others, since the occurrence of a tooth at the anterior edge in any species is most improbable; but the mystery is solved by the red-labelled specimen, in which each of the middle femora has a particle of dirt in the situation in which the conscientious artist has shown a tooth.

Before giving my notes upon the other Gory species of *Sisyphus* it will be well to review those which had been previously described at the date (1833) of the Monograph, several of them having been overlooked by Gory.

The genus *Sisyphus* was formulated by Latreille in 1807 for *Scarabæus schaefferi* of Linné. Two other species had been already described by Olivier in 1789, *S. muricatus* and *longipes*. The latter, which Olivier found in Lee's collection and of which he made a sketch, but perhaps omitted label with his intended name, was three years later foun

Fabricius in the same collection and again described by the name of *minutus*, both authors believing the species to inhabit the Cape of Good Hope. In 1798 Fabricius again described by the name of *helwigi*, this time rightly attributing it to India, the species to which the two earlier descriptions have been considered to apply. The type of *helwigi*, in the Copenhagen Museum, has been examined for me by Dr. Guy Marshall, and in the Oxford Museum I have found a specimen of this Indian species labelled "*longipes*?, P. B. S." (*i. e.*, Prom. Bonæ Spei), which is probably the one represented by Olivier upon his plate and the type both of *S. longipes*, Oliv., and *S. minutus*, F. A specimen of this species was given by Hope to Gory, figured by him, and is now again in the Hope collection.

In 1818 Thunberg described two South African insects attributed to the genus, *S. spinipes* and *costatus*, in 1823 Wiedemann added two more, *S. barbarossa* from South Africa and *S. hirtus* from Bengal, and in 1831 Hope described *S. indicus* from Nepal. The last five names were unknown to Gory, and two of them were unfortunately used by him for other species.

Thunberg's types are presumably at Upsala. There seems to be no adequate reason for referring his *Ateuchus costatus* to the genus, as has been done in Gillet's Catalogue, but his *Ateuchus spinipes* can be recognized with reasonable certainty and Wiedemann's *Sisyphus barbarossa* is in all probability the same species. The type of the latter is in the Copenhagen Museum. Of *S. hirtus*, Wied., I have been enabled to examine a male from Hamburg Museum, which I regard as the type. The type of *S. caschmirensis*, Redt., which has also been submitted to me from the Vienna Museum, is, as I have aleady recorded, a female of *S. indicus*, Hope, most easily distinguishable from *S. hirtus* by the presence of a slightly raised median line upon the pronotum.

I now give my notes on the species in Gory's 'Monographie':—

Sisyphus muricatus, Oliv.—Although the only Oxford specimen furnished with the red G is a male, Gory's figure represents a female. The male is referred to by Gory, and it has been figured by Péringuey in his 'Catalogue of the Coleoptera of S. Africa.'

Sisyphus spinipes, Gory.—This name cannot be used for Gory's species, as *Ateuchus spinipes*, Thunberg, described in 1818, is a very different insect. I therefore propose to give w name

Sisyphus mirabilis, nom. nov. (Pl. XII. figs. 1 & 2.)

to Gory's species, which is unmistakable, in spite of his bad figure, from the extraordinary legs in both sexes. Male and female are both mentioned by Gory, and a female is figured, but the two examples with a red G are both females. Péringuey's *S. spinipes* is neither the *spinipes* of Thunberg nor that of Gory, but, as he has himself suggested on p. 897 of his Catalogue, is *S. rugosus*, Gory.

Sisyphus quadricollis, Gory.—There is a single specimen bearing the red G, and I have seen no other example of the species. As remarked by Gory, the elytra are "less triangular than in all the other species." The figure, bad as it is, shows the elytra as unusually elongate, and also indicates, what could not be supposed from the description, that there is a tooth near the end of the middle femur and another corresponding near the base of the tibia.

Péringuey's *S. quadricollis* is not this species, but belongs to *S. spinipes*, Thunb., and *S. atratus* and *infuscatus*, Klug, also belong to that species, as I have ascertained by examination of types kindly sent to me by the Berlin Museum. *S. calcaratus*, Klug, treated in Gillet's Catalogue as a possible synonym of *S. quadricollis*, is a distinct species. I have been able to examine a type also sent to me from the Berlin Museum by Dr. Kuntzen. The middle femur and tibia are without teeth near the knee.

Sisyphus schaefferi, L.—Of this European species there are numerous specimens with a red G label, including one with var. *tauscheri* and one with var. *boschnakii* upon the label beneath in correspondence with the Monograph. Another bears the locality "Smyrne" and the name var. *vestitus*, Oliv. Coll., as quoted by Gory.

A renewed examination has shown that the insect named by me *S. morio* in 1909, from Chefoo in far Eastern China, is not distinguishable from *S. schaefferi*. The remoteness of its habitat from Europe led me to neglect a careful comparison.

Sisyphus hessii, Gory.—Two specimens with red G stand above the label bearing this name, both of them having the abdomen protruding as represented in the figure. Neither the author nor artist has noted the minute teeth upon the middle femur and tibia and hind femur. The species belongs to *S. spinipes*, Thunb., and not to *S. quadricollis*, as stated by Péringuey and the Junk Catalogue. The old label in

the Hope collection has also had the name "*quadricollis*, Gory," added by a later hand.

Sisyphus rugosus, Gory.—I have already mentioned the unique type-specimen of this species and stated that it is the one called *S. spinipes* by Péringuey on p. 104 of his 'Catalogue.'

Sisyphus capensis, Gory.—As already mentioned, this supposed South African species is the European and Asiatic *S. schaefferi*, L.

Sisyphus armatus, Gory.—A male and two females, marked with the G, as well as another specimen similarly marked, but evidently not belonging to the same species, stand above the label bearing this name. The male is no doubt that described and figured. This species is apparently not a common one.

Sisyphus crispatus, Gory.—Gory says of this "Du cabinet de M. Chevrolat," and no red-labelled specimens accompany the name *crispatus* in the Hope collection. Péringuey states (Catalogue, p. 897) that he has ascertained by examination of the type that the species is the same as *S hirtus*, Gory, but Gory has represented a specimen considerably larger than any I have seen of that common species (= *S. goryi*, Har), and I consider *S. crispatus* unidentified, pending the discovery of Chevrolat's specimen.

Sisyphus hirtus, Gory.—This name, having been preoccupied by Wiedemann, has been changed to *goryi* by Harold. There is a single red-labelled specimen, agreeing with the figure and description, which may be accepted as the type.

Sisyphus neglectus, Gory.—This is said to have been received by Gory from Hope with the locality "Gogo" (in Kathiawar). Above the label, which records "*Sisyphus neglectus*, Hope, Ind. or., Gogo. Monographie. D. Hope," there are three specimens, one bearing the red label, the other two without it but bearing Hope's labels, "*neglectus*, Hope. Gogo." The first belongs to the much smaller species next described by Gory as *S. minutus*, F. The other two, though larger, are smaller than the size given by Gory, nor have I seen any example of the species reaching that size. The actual specimen retained by Gory seems to have vanished, but as the species to which the name *neglectus* was given by Hope is the common one in the Bombay region, and, with the exception of the tiny *S. minutus*, I

know of no other from that region, the discrepancy is best accounted for by supposing that a mistake was made as to the size of the specimen figured. Hope's examples appear to have been all females. The hind femur in this species has a slender foot-stalk, as in *S. longipes*, Ol. (=*minutus*, F.), and in the male there is a sharp hooked process at its lower edge directed towards the base. The punctures upon the pronotum are large, shining, and scarcely at all sunk below the surface, in certain lights appearing almost as if elevated, which probably explains Gory's phrase "Corselet couvert de petits points élevés."

This species is closely similar to *S. denticrus*, Fairm., from Yunnan, Burma, and Assam, but that has closer and deeper punctures upon the pronotum.

Sisyphus minutus, F.—This, which was also obtained by Gory from Hope, I have already discussed under its older name of *S. longipes*, Oliv.

I add a few notes on some of the more recently described species of the genus.

Of the three Ceylon forms described by Walker in 1858 and 1859, the types of *S. setosulus* and *subsidens* are in the British Museum, while that of *S. prominens* is unknown. *S. setosulus* is synonymous with *S. hirtus*, Wied., and *S. subsidens* is a small species very closely allied to it. The metasternum is strongly punctured in the middle, and its anterior angles are a little hollowed and contain long hairs. In *S. hirtus* the anterior part of the metasternum is flat, without hollows or long hairs, and the depressed posterior part is very smooth and feebly punctured. *S. prominens* is a name which will probably always be without meaning and is best ignored.

S. appendiculatus, Boh.—This is evidently the species called by Péringuey *rubripes*, Boh. That was described from a female with the middle legs not toothed (probably a light-coloured *S. rugosus*, Gory). In *S. appendiculatus* the middle femora and tibiæ are toothed in both sexes.

When describing *Sisyphus gazanus* in 1909 I was mistaken as to the sexual characters. The shape of the clypeus does not differ sexually, as I then believed, but constitutes an important specific distinction. The insect which I believed to be the female of *S. gazanus* I have since found to belong to *S. nanniscus*, Pér. *S. gazanus* is one of those species in which the two sexes are practically identical. It is closely similar to *S. goryi*, Har., but the elytra are

broader and more rounded behind, the sides of the abdomen are without the tufts of bristles found in the latter, and the legs are a little stouter and less elongate.

Sisyphus callosipes, Arrow, is evidently very closely related to *S. transvaalensis*, Pér., described a few months earlier, but it is a northern species, of which I have seen no example from farther south than Nyasaland. *S. impressipennis*, Lansb., from Angola, is also, according to the description, a closely similar insect.

Sisyphus angulicollis, Felsche, of which Dr. Heller, of the Dresden Museum, has kindly submitted the type to me, is extremely like *S. armatus*, Gory, from which it differs, in addition to the sharp angulation of the sides of the thorax, in having the middle tibia of the male evenly tapered at the base and the hind trochanter of rather different form. The red colour may be a constant characteristic also.

In Ferret and Galinier's 'Voyage en Abyssinie,' Reiche states that *Sisyphus* shares with *Gymnopleurus* the remarkable peculiarity of having the elytra united together. the depression of the abdomen enabling the wings to be spread without separation of the elytra. This is quite incorrect. The elytra are separate in both genera, but do not embrace the sides of the abdomen in the usual way. In *Sisyphus* they are peculiarly narrowed behind, but not abruptly cut away at the sides as in *Gymnopleurus* and many Cetoniinæ. Reiche's remark that the hind trochanters of the males of all the species of *Sisyphus* are enlarged is also incorrect.

I add descriptions of three new species of the genus in the British Museum:—

Sisyphus gladiator, sp. n. (Pl. XII. figs. 4 & 5.)

Niger, antice paulo æneus, supra opacus, fere impunctatus, setis flavis inquinatis minutis haud dense instructus, clypeo antice leviter emarginato, dentibus duobus obtusis, pronoto compresso, lateribus postice fere parallelis, antice convergentibus, angulis anticis lobatis, disco postice vix sulcato; elytris fere obsolete striatis, setis subseriatis; corpore subtus lævi, metasterni medio rotundatim impresso; pedibus posterioribus longissimis, intermediorum femore et tibia intus pone genu dentatis:

♂, tibia antica paulo elongata, subtus bidentata, dente laterali tertio paulo remoto, tibia intermedia ante apicem fortiter lobata, femore postico subtus medio acute dentato, trochanteribus longissimis et acutissimis.

Long. 9–13 mm.; lat. max. 5·5–7 mm.

W. Africa, Kamerun: Ngpwdar, Tazada, Betare.

This is a large species of the *spinipes* group, but darker-coloured than *S. spinipes* or *rubripes* and with longer legs, the middle and hind femora being extremely long and the hind trochanters of the male little shorter than the femora. In the last feature it most resembles *S. armatus*, Gory, from which it differs conspicuously by the toothing of the intermediate femur and tibia. This is found in both sexes, as in *S. spinipes*, but the femoral tooth is much stronger than in that species. The hind tibia of the male is very strongly curved and bears widely-spaced tubercles at its inner edge. These are almost absent in the female, in which also the trochanters are scarcely free, forming only a minute spine at the tip. The front angles of the thorax form conspicuous blunt lobes, produced outwards a little.

Sisyphus laoticus, sp. n.

Niger, capite æneo, nitidus, setis flavidis parum perspicuis sat parce vestitus; ovatus, capite et pronoto sat crebre punctatis, illo antice fortiter emarginato, bidentato, dentibus modice distantibus; pronoto convexo, ad basin breviter longitudinaliter sulcato, lateribus postice compressis, fere parallelis, antice convergentibus, angulis anticis acutis; elytris brevibus, leviter striatis, intervallis parcissime setosis; corpore subtus nitido, metasterni medio parce punctato, postice rotundatim impresso, metasterni et abdominis lateribus grosse annulato-varioloso; tibiis anticis fortiter tridentatis, pedibus posticis gracilibus, basi sat longe attenuatis:

♂, femore postico subtus medio tuberculo truncato munito.

Long. 6–7 mm.; lat. max. 4 mm.

Indo-China, Upper Mekong R.: Vieng Vien, Vieng Vai (May, June, *R. Vitalis de Salvaza*).

S. laoticus is a rather globose species, with the upper surface smooth and shining and very scantily clothed with setæ, as in *S. longipes*, Oliv. It is a little larger than that, and the legs are not quite so slender. The front tibiæ are more massive, with strong teeth, which occupy half the length of the outer edge, and the hind legs have less prominent trochanters and less elongate bases to the hind femora. It is still more closely related to *S. neglectus*, Gory, which is rather more closely punctured and setose above. The male is easily distinguishable from that of *S. neglectus* by the shape of the tooth upon the hind femur. This is a narrow truncate tubercle, like that of *S. indicus*, Hope, and not a hook-like continuation backwards of the lower edge. Another slight distinguishing feature is found in the metallic metasternum.

Sisyphus araneolus, sp. n.

Rufescens, subcupreus, fere opacus, setis flavidis minutis haud crebre vestitus; ovatus, convexus, capite fortiter punctato, margine antico dentibus acutis distantibus armato; pronoto transverso, sat fortiter annulato-punctato, postice longitudinaliter sulcato, lateribus postice compressis, leviter divergentibus, antice valde convergentibus, angulis anticis acutis; elytris latis, striis laxe punctatis impressis; metasterno fortiter punctato, postice rotundatim depresso; tibiis anticis longe tridentatis, pedibus 4 posterioribus gracilissimis, femoribus posticis basi attenuatis: ♂, femore et tibia intermediis pone genu dentatis, femoris postici margine postico acute spinoso trochanterique acute producto.

Long. 5·5 mm.; lat. max. 3·5 mm.

S. India, Nilgiri Hills: Gudalur (*E. E. Green*, May).

Two specimens of this very distinct little species are apparently both males. It is reddish and slightly coppery upon the head and prothorax, shining beneath and almost opaque above, with minute yellowish hooked setæ. The posterior legs are very slender, the front tibia is armed with three sharp teeth occupying less than half the outer edge, the basal half of the hind femur forms a slender foot-stalk, and the hind trochanter is produced into a short acute spine at the tip. The head is strongly and closely punctured, and the front margin bears two small acute teeth placed rather far apart and separated by a curvilinear excision. There is a fine median groove upon the posterior half of the pronotum, the lateral margins are sharply angulate before the middle, the front angles are acute and the posterior flattened lateral area is very sharply defined and sparsely punctured. The elytra are a little longer than their combined width, and bear very shallow, coarsely punctured striæ. The mesosternum is closely punctured, and the metasternum has a roundish posterior depression and is coarsely and rather closely punctured at the sides and in the depression.

Synonymical List of the Species of Sisyphus *known to me.*

Angles of the clypeus not dentate.

spinipes, *Thunb.*
  hessii, Gory.
  barburossa, Wied.
  atratus, Klug.
  infuscatus, Klug.
  quadricollis, Pér.
appendiculatus, *Boh.*
  rubripes, Pér.
fortuitus, *Pér.*
rugosus, *Gory.*
  spinipes, Pér.
gladiator, sp. n.
armatus, *Gory.*
calcaratus, *Klug.*
mirabilis, nom. nov.
  spinipes, Gory.
tibialis, *Raffr.*
bowringi, *White.*

Median teeth of clypeus separated by a shallow emargination.

muricatus, *Oliv.*
fasciculatus, *Boh.*
quadricollis, *Gory.*
biarmatus, *Felsche.*
angulicollis, *Felsche.*
callosipes, *Arrow.*
gazanus, *Arrow.*
goryi, *Har.*
    hirtus, Gory.
nodifer, *Gerst.*
schaefferi, *L.*
    capensis, Gory.
    morio, Arrow.
mexicanus, *Har.*

tarantula, *Arrow.*
araneolus, sp. n.
thoracicus, *Sharp.*
denticrus, *Fairm.*
laoticus, sp. n.
indicus, *Hope.*
    caschmirensis, Redt.
neglectus, *Gory.*
longipes, *Oliv.*
    minutus, F.
    helwigi, F.
hirtus, *Wied.*
    setosulus, Walk.
subsidens, *Walk.*

Median teeth of clypeus separated by a deep emargination.

seminulum, *Gerst.*
    rugosus, Roth.
    nanniscus, Pér.

ocellatus, *Reiche.*
regnardi, *All.*

Species unidentified.

crispatus, *Gory.*
caffer, *Boh.*
sordidus, *Boh.*
rubripes, *Boh.*
impressipennis, *Lansb.*

transvaalensis, *Pér.*
setiger, *Roth.*
trochantericus, *Fairm.*
penicillatus, *Har.*
prominens, *Walk.*

EXPLANATION OF PLATE XII.

Fig. 1. *Sisyphus mirabilis*, Arrow, male.
Fig. 2. *S. mirabilis*, female.
Fig. 3. *S. tarantula*, Arrow, male.
Fig. 4. *S. gladiator*, Arrow, male.
Fig. 5. *S. gladiator*, female.
Natural size.

XLVI.—*A Note on the Coleopterous Genus* Trox, *with Descriptions of a few new Asiatic Species.* By GILBERT J. ARROW.

BY an unfortunate accident, the Catalogue of Trogidæ, compiled by me and published in Berlin in 1912, omitted the names of certain African and Australian species of the genus *Trox* published in 1904. In order to obviate any complications which might in the future result from this omission, I record these species here. They are :—*T. nigrociliatus*, *raduloides*, *annexus*, *massaicus*, *erlangeri*, *neumanni*, *amitinus*, Kolbe, Berl. Ent. Zeits. vol. xlix. pp. 292–294, and

T. tasmanicus, setosipennis, eyrensis, tricolor, perhispidus, Blackb. Trans. Roy. Soc. S. Austr. vol. xxviii. pp. 292–296.

The type of *T. tricolor*, Blackb., in the British Museum, is a specimen of the very abundant American *Trox suberosus*, F. Its appearance in Sydney was probably accidental.

Another redundant name is *obscurus*, Wat., which is a synonym of *T. chinensis*, Boh.

On the other hand, *T. umbonatus*, Lec., although united by Horn with *Trox scutellaris*, Say, is certainly distinct. It is a peculiarly narrow species, with the thoracic margins more rounded behind than those of *T. scutellaris*, and the elytral tubercles coalescing transversely and effacing the longitudinal series. A specimen from Monclova, Coahuila, Mexico, recorded by Bates as *T. scutellaris*, belongs to *T. umbonatus*.

I take advantage of this opportunity to describe a few new Asiatic species of *Trox* in the British Museum.

Trox testudo, sp. n.

Niger, griseo-pulverulentus, elytrorum plagis parvis nitidis raris sparsutis: late ovalis, convexus, lateribus denticulatis, capite postice transverse elevato; pronoto brevi, postice vix lobato, ad angulos posticos latissimo, medio leviter longitudinaliter impresso, lateribus leviter arcuatis, denticulatis; elytris breviter rotundatis, grosse seriato-punctatis, intervallis granulis parvis nitidis hic et illic instructis; tibiis anticis extus lobis duobus obtusis denticulisque basalibus nonnullis armatis, tibiis intermediis extus denticulatis; antennis basi obscure pilosis.

Long. 15 mm.; lat. max. 10 mm.

INDIA: Karachi.

The broadly rounded form of the body distinguishes this readily from other Indian species. It is most nearly related to *T. omacanthus*, Har., which has similarly sculptured elytra, sharply produced at the shoulders, as well as very stout subapical and median lobes to the front tibiæ, but, in addition to the shorter and rounder shape, the more feeble median sulcus of the pronotum distinguishes *T. testudo* without difficulty. Although partially divided, there is only a single frontal prominence instead of the usual two separate tubercles.

Trox lobicollis, sp. n.

Niger, griseo-pulverulentus, plagis raris nitidis sparsutis: oblongus, paulo angustus, lateribus haud denticulatis, capite triangulari, postice bituberculato; pronoto brevi, postice vix lobato, impresso, medio triangulariter elevato, haud sulcato, lateribus subangulariter bilobatis; elytris seriebus tuberculorum magnorum et

parvorum alternatis instructis, illis antice, his interdum toto nitidis, humeris angulatis, haud productis, lateribus fere parallelis; tibia antica extus lobo rotundato subapicali denteque minutissimo mediano armata, apice acuminata, tibia intermedia haud denticulata; prosterno postice minute et anguste carinato.

Long. 14–16 mm.; lat. max. 8–9 mm.

TENASSERIM: Moulmein (*L. Fea*, May).

BURMA: Rangoon (*L. Fea*, June, Oct.).

There are co-types of this species in the Genoa Museum and the Entomological Institute, Dahlem, Berlin.

It resembles rather closely *T. inclusus*, Walk., from Ceylon and Southern India, but has numerous points of difference. It is longer and narrower, but with the prothorax relatively shorter and less produced behind, without the strong median groove of *T. inclusus*, and with its sides rather deeply notched in the middle, dividing them into two lobes. The conformation of the surface of the elytra is almost the same as in *T. inclusus*. The front tibiæ are shorter and stouter, more sharply produced at the tip, and bear a large rounded lobe and a minute tooth at the outer edge. The scape of the antenna is tufted with dark hair.

Trox birmanicus, sp. n.

Niger, griseo-pulverulentus, antennis basi fulvo-setosis, clava fulva; ovalis, convexus, lateribus haud denticulatis, capite triangulari, postice bituberculato, pronoto haud lato, lateribus leviter bisinuatis, angulis posticis prominentibus, medio sulco antico angusto, postice dilatato, impresso; elytris tuberculorum velutinorum seriebus numerosis nonnullisque nitidis interspersis, humeris angulatis, haud productis, lateribus fere rectis, leviter divergentibus, postice late rotundatis; tibia antica lobo lato subapicali denteque minutissimo mediano armata, apice acuminata, tibia intermedia haud denticulata; prosterno postice minute denticulato.

Long. 12 mm.; lat. max. 7·5 mm.

UPPER BURMA: Pakokku, 180 ft. (Jnne, Sept., *Mrs. Molesworth*).

LOWER BURMA: Prome (*G. Q. Corbett*), Minhla (*Comotto*).

CAMBODIA: Kompong Kedey (May, *R. Vitalis de Salvaza*).

The specimen from Minhla is in the Genoa Museum.

T. birmanicus is closely related to *T. inclusus*, Walk., but may be readily distinguished by the tubercles upon the elytra not forming conspicuously alternate series, although the third and fifth rows contain a few of larger size. (*T. inclusus* has three series of large tubercles alternating with very much smaller ones.) The pronotum of the new

species has a deep median groove, which, instead of narrowing behind as in *T. inclusus*, is widest behind and narrow in front. The front tibia has a very slight tooth at the middle of its outer edge, which is not found in the allied species. The club of the antenna and the hairy tuft upon the scape are bright orange, as in *T. inclusus* and *T. italicus*. There is a still closer resemblance to *T. chinensis*, Boh. (=*obscurus*, Wat.), which differs by the much smaller elytral tubercles, narrow median groove of the thorax, and generally more prominent lateral lobes.

Trox mollis, sp. n.

Niger, corpore supra pedibusque cinereo-pulverulentus, abdomine subtus tibiisque anticis nigris, nitidis, antennis fulvo-setosis, clava fulva; ovalis, convexus, haud rugosus, lateribus haud denticulatis, capite postice leviter transverse carinato; pronoto spongioso, medio carinis duabus subrectis angustis instructo, lateribus obliquis, fere rectis, angulis posticis prominentibus, haud acutis; elytris regulariter sat minute punctatis, intervallis æqualiter leviter costatis, costis lineisque punctatis minute denticulatis, humeris rotundatis, lateribus antice rectis, divergentibus, postice late rotundatis; tibiis anticis acutissime tridentatis; prosterno postico conico.

Long. 13 mm.; lat. max. 8 mm.

Borneo. Sumatra: Palembang (*J. Schmitz*), Medan (*L. Fulmek*).

Malay Peninsula: Kuala Lumpur, Selangor (*H. M. Pendlebury*, August).

The co-type from Medan is in the Entomological Institute, Dahlem, Berlin. The Bornean specimen was purchased in 1875 by the late Alexander Fry, and was probably taken by Wallace in Sarawak.

The genus has not been previously recorded from either Borneo or Sumatra, but a specimen of *T. costatus*, Wied., taken by H. D. Jensen in E. Borneo, is in the British Museum. The new species is nearly related to that insect, but it is larger, the elytral punctures are closer and more numerous, and the costæ, instead of elongate velvety patches with conspicuous smooth intervals, are closely set with minute spiny tufts, producing a more uniform texture of the surface than that of any other *Trox* known to me. The very sharply tridentate front tibiæ also are quite distinctive of this species.

Mr. Pendlebury found this and the related species, *T. costatus*, in Bat guano in hollow trees.

XLVII.—*On the Structure of* Glyptograptus *aff.* tamariscus (*Nicholson*). By W. F. Whittard, Ph.D., D.I.C., A.R.C.S., Sedgwick Museum.

[Plates XIII. & XIV.]

It has been the custom to include under the name *Glyptograptus tamariscus* many nearly related forms which differ slightly in structure. The differences are not always great and although the individuals are obviously allied to *G. tamariscus*, yet they cannot be included in this form because they do not conform to the species originally described by Nicholson (2)* and they can best be considered as belonging to the *G. tamariscus* species-group. A type occurring in the Upper Valentian rocks of Shropshire was therefore selected, with the object of establishing certain criteria by which it might be definitely distinguished from *G. tamariscus*, as described by Nicholson (2) from Skelgill in the English Lake District. It may be found that there are at least three different forms of restricted stratigraphical range referred to *G. tamariscus*. The lowest is elongated and slowly tapering, occurring in the zone of *Monograptus cyphus*; the Lake District form is apparently confined to the sub-zone of *Monograptus argenteus*, while the highest member of the group is found in the *Monograptus sedgwicki* zone, and is the form here described. Stratigraphically, the use of the term *G. tamariscus* for the species-group has little value because it ranges from the zone of *Monograptus cyphus* to the base of the Gala.

I. Technique.

During the last few years there has been a revival of the methods originally employed by Gümbel (6), Törnquist (7, 11), Holm (8, 15), Gürich (17), Sollas (10), Wiman (12, 16, 18, 20), and Perner (13) in the determination of the detailed structures of graptolites. Slight modifications only of the principles involved has led to a more comprehensive examination of fossil plants by Walton (24) and Hamshaw-Thomas (27), while Hundt (23), Bulman (25), and Kraft (28) have been able to determine certain structures of the Graptolithina in greater detail, mainly as the result of the application of more advanced microtechnical methods. The technique employed in the determination of the structure of *G.* aff. *tamariscus* (29) is in no wise essentially

* Numbers in brackets refer to Literature, p. 475.

different from that used by Wiman, who fully described his methods of isolation but did not give details of the later stages of the process; therefore its application is somewhat vague and to facilitate future work a more complete description has been published (*op. cit. supra*).

II. Geological Horizon.

Glyptograptus aff. *tamariscus* is abundant only in one thin band in the Valentian rocks of the main outcrop in Shropshire. The rock is a flaggy, micaceous, calcareous grit, about one foot in thickness, which outcrops both in Harper's Dingle, near the Wrekin, and Gilberries Brook, near Cardington. It has yielded a mixed fauna, the graptolites being represented by *G.* aff. *tamariscus*, *Monograptus nudus*, and *M. gemmatus* associated with *Pentamerus oblongus*, *Schuchertella pecten*, *Atrypa reticularis*, *Favosites fibrosus*, *Encrinurus punctatus*, and Conodonts. The age of the deposit cannot be ascertained with precision, but it appertains either to the top of the Upper Birkhill or the base of the Gala.

III. Structure.

The Sicula *.

The sicula, or embryonic theca, is a hollow conical structure, which is only partially exposed because of the enveloping growth of later thecæ. The aperture is directed downward and the left side † of the sicula-margin is first prolonged as a thickening of the wall and, finally, as a solid spine or virgella [5, 7, 13] ‡. Distally, the sicula extends nearly to the level of *th* 2^1 and is continued as a rod which, as suggested by Wiman (13) and later confirmed by Ruedemann (15), is a hollow structure. However, in all specimens of *G.* aff. *tamariscus* that have been sectioned, the nema is unquestionably solid but it is difficult to determine whether the cavity was filled during life or whether it has been infilled subsequently. Also, in the majority of siculæ examined, the distal portion of the cavity is partly obliterated [95–140], suggesting that both the sicula and the

* For definition of terms, see Proc. Geol. Assoc. 1922, p. 199.

† Throughout this communication the usual orientation of a graptolite is adopted, viz., the left side is that on which opens the first theca, and the obverse or front side is that which exposes the largest portion of the sicula (text-fig. C).

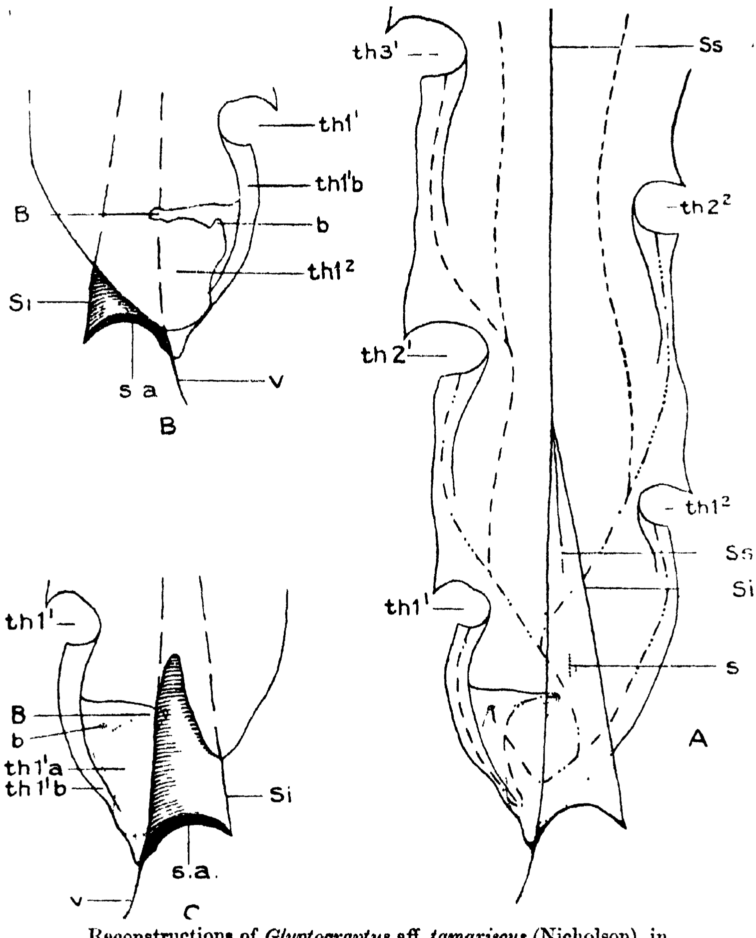
‡ Numbers in square brackets refer to the sections in the microtome series, figured either on Plates XIII. or XIV.

nema tended to become infilled with a granular substance during the later stages of development of the rhabdosome, resulting in the complete or partial obliteration of their respective cavities. The very fact that the granular matter has resisted disintegration when placed in hydrofluoric acid, indicates that it is probably composed of a similar refractory substance to the graptolite. The granules may conceivably be sections of fibres aligned parallel to the length of the sicula, but from their irregular distribution it seems more probable that they are granules secreted from the sicula-wall into the protoplasm of the individual which occupied the sicula-cavity, and in this way the apex of the sicula became strengthened. Alternatively, the sicula may have secreted material from the outside of its wall which accumulated and formed an enclosing sheath to serve as a protective organ for the apical portion of the sicula. The local thickening of the sicula and the consequent reduction of its cavity may be due to an abortive attempt at a formation of this enveloping membrane. Such a membrane may be prolonged proximally when it forms a float or a defensive organ to the sicula, as in certain Dichograptids, in *Climacograptus wilsoni*, *C. bicornis* var. *peltifer*, *Dimorphograptus physophora*, *Monograptus pala* (9) and *M. priodon* (26), or it may completely enclose the nema, which in such cases is usually very fragile, extending beyond the colony as a float, as, for example, in *Orthograptus vesiculosus* and *Climacograptus tubuliferus*.

The Bud.

Arising as an outgrowth from the reverse side of the sicula the bud grows downward and is partly contained in a fold in the wall of this organ [61, 66], but above the opening of the bud the walls of the fold close up and are continued, for a short distance only, as a projection into the sicular cavity [76]. Of interest is the fact that only part of the area of the fold is occupied by the primary bud [61–66] because in the Monograptids there is some evidence that the whole of the fold is utilised. The aperture which permits connection between the bud and sicula in *G.* aff. *tamariscus* is small in proportion to the size of the cavities which it joins, thus the fold may have served as a support to the bud.

The bud develops outward and downward until it comes to lie on the left side of the sicula, with which it remains in juxtaposition for the rest of its downward growth (text-fig. C). The position at which the bud becomes the first



Reconstructions of *Glyptograptus* aff. *tamariscus* (Nicholson), in which an uncrushed condition is assumed. ×90 approx.

Fig. A.—Reverse half of rhabdosome viewed from inside. Dotted lines represent those parts which are situated on the reverse side of the median plane.

Direction of growth of first theca.
" " second "
" third "
" fourth "
" fifth "
" sixth "
" seventh "

Fig. B.—Reverse side of the proximal portion of colony to show development of first two thecæ.

Fig. C.—Obverse side of same to show sicula.

Si, sicula; *s*, primary septum; *Ss*, secondary septum; *B*, bud of first theca; *b*, bud of second theca; *v*, virgella; *s.a*, sicula-aperture; *th* 1¹ *a*, downward developing portion of first theca; *th* 1¹ *b*, upward developing portion of first theca; *th* 1¹, *th* 1², *th* 2¹, *th* 2², *th* 3¹, first, second, third, fourth, and fifth thecæ respectively.

theca is difficult to delimit because their cavities are contiguous; however, the place of division must be taken proximal to the origination of *th* 1^2. Below the sicula-orifice the thecal cavity turns and develops upward, opening to the exterior as thecal aperture *th* 1^1. The upward and downward growing portions of the first theca are separated by a wall which is first seen at the level of the opening of the sicula [30] and most probably persists as far as the aperture of the first theca (see text-fig. C).

In longitudinal section the apertural margin of each theca is slightly extroverted and with the characteristic sacculate shape, the outline of the rhabdosome simulates the general configuration of Climacograptids. Also, in the vicinity of each thecal opening the rhabdosome is locally thickened and the upper lip is invariably subspinose (see transverse sections through the first, second, and third thecæ, Pl. XIV.).

The *second theca* commences as an outgrowth from the reverse side of the bud, grows downward and outward to the left of the rhabdosome, turns at the level of the sicula-orifice and develops obliquely and upward, opening eventually on the right side opposite and above the first theca (text-figs. A and B): throughout the rhabdosome there is a pronounced alternation of the thecæ.

Obversely, the *third theca* cannot be differentiated from the second theca since there is no interthecal wall, but on the reverse side they are separated by the first, or primary, portion of the median septum (fig. A, *s*). The individual which occupied *th* 1^2 budded forth a third body, which grew upward on the left side of the discontinuous septum and opened directly above *th* 1^1. From this third theca are developed the fourth and fifth thecæ; the former crosses to the right side of the colony through the cavity between the primary and secondary portions of the median septum (text-fig. A, *s* and *Ss*), while the fifth theca is developed after *th* 2^2, on the same side as *th* 2^1. Thereafter the thecæ are formed in an upward linear series on either side of the median septum, which completely separates the opposed thecæ. Between thecæ of more recent development than *th* 1^2 the interthecal partitions have a decided sigmoidal flexure, which is slightly reminiscent of the curvature of the ventral walls in a typical Climacograptid.

The Median Septum.

Earlier descriptions of *G. tamariscus* (2, 3, 19, 21, and 22) have always mentioned the absence or impersistence of the

median septum. However, in all specimens examined from the calcareous grit, there can be little doubt that the septum is one of the best-developed structures, although its continuity is broken at the level of the orifice of *th* 1^1 where *th* 2^2 crosses over from the left to the right side of the colony (text-fig. A). But among Nicholson's type-specimens of *G. tamariscus* there are some in which the septum is absent on the reverse side, an example of the great variation of the septum regnant in this form and suggesting that the name *G. tamariscus* embraces more than one species and probably constitutes a species-group. The *primary* septum originates as a thick ingrowth from the rhabdosome wall, effects direct connection with the reverse side of the sicula, then becomes attenuated and finally breaks down a short distance below the aperture of *th* 1^1 [see 78–85]. The *secondary* septum commences just above *th* 1^1 and again develops on the reverse side of the colony, but it arises as an outgrowth from the sicula and eventually separates the left and right portions of the colony in its reverse moiety [110, 115]. There is now a thickening of the inner side of the front part of the rhabdosome and a complementary outgrowth from the obverse side of the sicula, which results in complete connection, separating the front of the colony into two halves [120–140]. The median septum is thus entire and persists upward, dividing the rhabdosome into two distinct and separate entities. Although near the nema the septum is approximately straight, when traced outward it becomes undulose, the amplitude of the folds steadily increasing.

The median septum in *G.* aff. *tamariscus* may possibly be of a different origin from that suggested by Törnquist in certain Climacograptids; this author indicated that the septum is a double structure arising by the adhesion of opposing thecal walls. In the above form, however, it is apparent that the development of the septum is directly related to the sicula and rhabdosome walls, being formed by an outgrowth and ingrowth of their respective margins. Hence, the median septum of the biserial graptolites may have evolved along two distinct lines. In 1853 Richter (1) figured a section of *Diplograptus palmeus*, illustrating a septum closely analogous to the structure of this organ in *G.* aff. *tamariscus* when it develops from the reverse side of the sicula [*cf.* 110].

IV. Relation to the Biserial Graptolites.

Structurally, the genus *Glyptograptus* appears to possess characters which are ancestral to, and intermediate between, typical Climacograptids and Diplograptids.

In transverse section it is only the initial portion of the rhabdosome that exhibits a concavo-convex outline, for above the first theca a bi-convex shape is rapidly adopted, and with the sacculate thecal aperture *G.* aff. *tamariscus* approaches the general profile of a Climacograptid. Also, the exposed surface of the sicula on its obverse side is much greater than that usually observable in Diplograptids (text-fig. C), and this character finds better parallel in the Climacograptids where, generally, the sicula is nearly completely uncovered.

Primarily, however, *G.* aff. *tamariscus* is allied to the Diplograptids in its mode of development of the median septum, in the growth of the earliest thecæ, and in the gentle curvature of the ventral wall of all the thecæ; these are features of paramount importance, linking this fossil with the Diplograptids.

Besides giving rise to later forms of its own genus, the primitive Glyptograptid stock developed the Climacograptids and the Diplograptids as offshoots from the main evolutionary line. Whatever resemblances the fossil herein described bears to either the Climacograptids or the Diplograptids, it is certain that it unites some of the primitive characters of both groups—characters which have persisted from a common Glyptograptid ancestor.

My best thanks are due to Professor W. W. Watts, F.R.S., who has supervised my research for the last two years. Dr. G. L. Elles has given me invaluable advice and I have profited by her experience while writing this paper. Professor H. G. Cannon very kindly assisted me when first applying the technique here adopted and I wish to thank Professor E. W. MacBride, F.R.S., for permission to work in his laboratories and for the use of zoological apparatus. Finally, I wish to acknowledge the financial help received from the Department of Scientific and Industrial Research.

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Literature numbers 2, 3, 4, 5, 19, 21, and 22 constitute the synonomy for *Glyptograptus tamariscus* (Nicholson), 1868.

EXPLANATION OF THE PLATES.

Transverse sections of *Glyptograptus* aff. *tamariscus* (Nicholson). × 35.

Plate XIII.

Section numbers 5–83, selected from microtome series A.
Section number 85 selected from microtome series B.

Plate XIV.

Section numbers 87–210, selected from microtome series B.
All sections cut at 5 μ.

Remarks on Sections.

Section no.	Plate XIII.
5	Shape of virgella (*v*) in cross-section.
7 & 13	Basal portion of *th* 1^1.
24	Wall between *th* 1^1 and *th* 1^2: aperture of sicula (*s*) incomplete.
26	Aperture of sicula nearly complete.
30	Development of wall separating downgrowing (*th* 1^1 *a*) from upgrowing (*th* 1^1 *b*) portions of *th* 1^1.
44	Enlargement of upgrowing *th* 1^1.
61	Origination of bud (*b*) of *th* 1^2 from bud (B) of *th* 1^1; also fold in sicula-wall (F).
63	Opening of bud (*Bo*) of first theca into sicula-cavity.
66	Fold in sicula-wall (F) and persistence of bud (B) above the level of its outgrowth from sicula.
76	Fold closed up (*w*) forming a projection into sicula-cavity (*s*).
78	Ingrowth from the reverse wall of the rhabdosome, to form primary septum (*S*).
79	Direct connection of the wall of rhabdosome and sicula by the primary septum (*S*).
81	Absence of double wall formed by closing of fold in sicula.
83	Breaking down of primary septum.
85	Absence of primary septum and sicula nearly embedded; opening of *th* 1^1.
	Plate XIV.
87	Sicula completely surrounded.
95 & 100	Sections through thecal aperture *th* 1^1. Note thickening of wall in vicinity of the opening.
105	Origination of thecal wall between *th* 1^2 and *th* 2^2.
110	Outgrowth of secondary septum (Ss^1) from the reverse side of sicula.
115	Direct connection of the secondary septum (Ss^1).
120 & 123	Outgrowth and ingrowth from sicula and rhabdosome walls (Ss^2).
130	Complete median septum (Ss^1 and Ss^2) and thecal wall separating *th* 1^2 and *th* 2^2.
140 & 155	Sections across thecal aperture *th* 1^2.
180	Solid nema (*n*) and differentiation of thecæ by inter-thecal partitions.
185–210	Sections across thecal aperture *th* 2^1; solid nema (*n*).

Sections 95–140 show the partial, or complete granular infilling of the sicula-cavity.

Owing to bad preservation, the wall between *th* 1^1 *b* and *th* 2^1 is not shown in sections 78–83.

XLVIII.—*The Earliest Records of the Giraffe.*
By Warren R. Dawson, F.Z.S.

[Plate XV.]

As in the case of the Elephant *, so also in the case of the Giraffe, the earliest records are to be found in Egypt. Before specifying the various representations of the animal as found on the monuments of ancient Egypt, it is necessary to summarise briefly certain zoological features in order that we may be able to appraise the accuracy or otherwise of the Egyptians in their rendering of its form.

There are two well-marked species of Giraffe, the first of which, *Giraffa reticulata,* is confined to Somaliland. This animal is of a deep liver-red colour, and is marked with a network of fine white lines, the intervening dark areas being sharply defined and rectangular in shape. The legs below the hocks and knees are white, and the whole effect of the coloration is that of a dead-white network spread over a dark reddish ground. Paton is certainly wrong in identifying the Egyptian pictures of the Giraffe with this species †. The other species is *G. camelopardalis*, and of this a considerable number of local races, or subspecies, has been described. The essential characteristic of the whole species is the light tawny or yellowish background, which is blotched rather than netted with a number of irregular markings of a deeper colour, which varies through many shades from chestnut-brown to almost black. The unpaired median horn in the centre of the forehead is well developed in the adult males of the northern races, and tends gradually to disappear as we proceed further south, until it is reduced to a mere boss in the most southerly races (*G. c. wardi* from the Transvaal and *G. c. capensis* from the Cape). Conversely, in the northern races, ranging from the Soudan, the legs are unspotted and white below the knee, whilst in the southern races, the legs are spotted right down to the hoof. We can trace this progression in the spotting of the legs and the continuous diminution of the median horn in the various local races which inhabit the intervening areas. The race or races known to the Egyptians are, of course, of the northern type, which have the median horn well

* W. R. Dawson, Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. pp. 655–659.

† 'Animals of Ancient Egypt,' p. 25.

developed in the males and the legs white and unmarked below the knee *.

Like the Elephant, the Giraffe occurs on the carved ivory objects of pre-dynastic and proto-dynastic age, and we may infer that at that remote time it was an inhabitant of Upper Egypt. A well-carved figure of the animal is to be seen on the Carnarvon Ivory. Unfortunately, it is somewhat damaged and the head is missing (text-fig. 1). On the Davis Ivory, however, it is complete, and is represented with a well-developed median horn (text-fig. 2), and on a similar object in the Brooklyn Museum, the Giraffe occupies the same position †. On a gold axe-handle, discovered in Nubia some years ago, the decoration consists of a series of animals analogous to those depicted on the Ivories, and amongst these is a bold etching of a Giraffe, which is shown with somewhat conventionally rendered reticulated markings which recall those of *G. reticulata*, but there can be no doubt that the ancient artist was attempting to portray the Nubian race (*G. c. typica*). This object Dr. Reisner believes to be contemporary with the First Egyptian Dynasty—that is to say, about 3400 B.C. ‡ (see text-fig. 3).

These examples are all relatively well executed. Much rougher figures of Giraffes are found scratched or drawn upon prehistoric pottery. I here reproduce an example from a prehistoric pot found at Mahasna § (see text-fig. 4). Giraffes figure also upon the primitive palettes from Egypt, good examples of which have been published ||.

Of the period represented by the Middle Kingdom (circa. 2000 B.C.) I know of only one instance of the Giraffe. Here the animal is represented in a hunting scene in association with the stag, oryx, lion, and other animals, in the tomb of Ukh-hotp, at Meir (5, Pl. XV.). Dr. Blackman, who has published this tomb *in extenso* ¶, informs me that the decoration of the tomb is unfinished, and the figure of

* For a detailed discussion of the local races of Giraffe, see the important paper by R. Lydekker in Proc. Zool. Soc. 1904, part i. pp. 202 ff., with a series of fine coloured plates.

† The Ivories, to which reference was made in my previous paper on the Elephant. See Bénédite, Journ. of Egypt. Archæology, vol. v. 1918, pp. 1 ff., and plates i., xxxiii., and xxxiv.

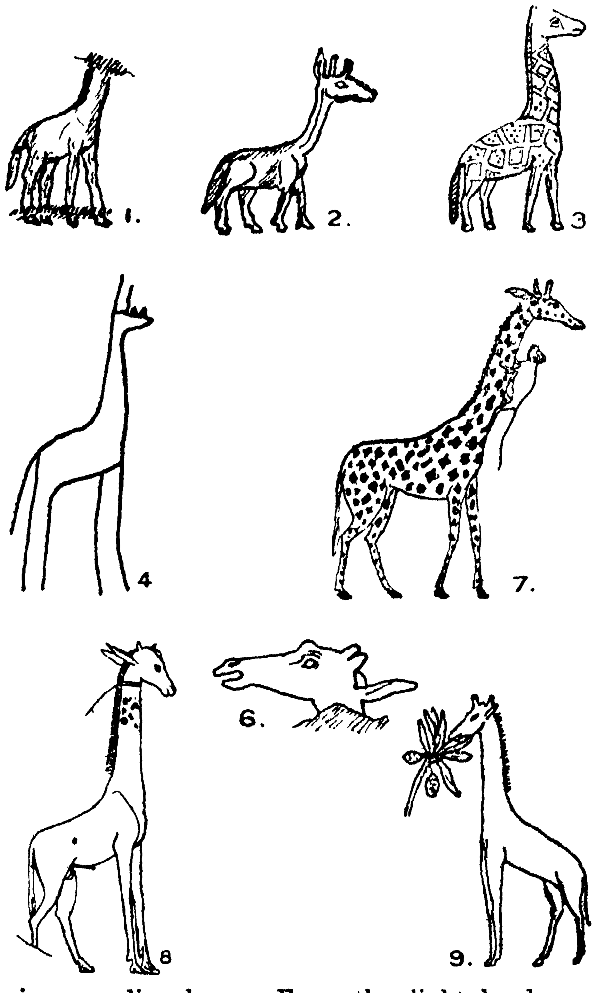
‡ 'Bulletin of the Archæological Survey of Nubia,' No. 7, p. 18.

§ Garstang, 'Mahasna and Bet Khallâf,' plate iv. See also Petrie, 'Naqada,' pl. xxix. figs. 91–98; Capart, 'Le Préhistorique Egyptien,' p. 5.

|| Legge, Proc. Soc. of Biblical Archæology, vol. xxvi. 1904, p. 262.

¶ Blackman, 'The Rock Tombs of Meir,' part ii.; see especially plates 8 and 32.

the Giraffe is merely sculptured, and has unfortunately never been painted. We are, accordingly, deprived of any evidence as to colouring, but we can see that the animal is a bull and that the sculptor has been faithful to nature in



rendering a median horn. From the slight development of this horn and from the small stature of the Giraffe, as compared with the other animals which surround it, we have a fairly faithful picture of an immature bull of the Nubian race.

Under the Eighteenth and succeeding Dynasties, we meet with the Giraffe several times. It is by this time, without question, no longer a native of Egypt, and is included amongst the pictures of rare and valuable animals brought as tribute or spoil from Nubia. In the Great Temple of Deir-el-Bahari, there formerly existed what must have been an admirable picture of the animal, but it has unfortunately been destroyed with the exception of the head, the rendering of which is so good as to make the loss of the rest all the more regrettable (text-fig. 6). The incomplete development of both paired and unpaired horns shows us that here again the animal was an immature bull. In the tomb of Rekhmere, which is a little later in date, is the best-preserved picture of a Giraffe which has survived (text-fig. 7). Here the animal is seen being led by two attendants by means of cords attached to its fetlocks, and a baboon clings to the under surface of its neck. The coloration is tawny yellow, with pinkish-brown irregular star-like markings. The star formation to render spots or maculations of animals is a common convention of Egyptian drawing, and is specially frequent in their pictures of cattle, but the whole effect is not at all unlike the immature cow Giraffe from the Egyptian Soudan figured by Lydekker (*op. cit.* plate x.), which has small star-like markings conspicuously different from the larger and more reticulated markings of the young bull Giraffe from the same locality (*op. cit.* plate ix.). The Egyptian artist, however, even if correct in other respects, has made one serious error, for the legs are shown as spotted down to the hoofs, a characteristic feature of the southern races, and of which there is not the slightest trace in animals from so far north as Nubia. The first beginnings of the spotting of the lower portion of the legs makes its appearance in the race which inhabits the Kilimanjaro district, and this feature does not attain full development until a much more southerly latitude is reached. As far as can be seen from the present damaged condition of the Giraffe in the tomb of Rekhmere, it appears to be an immature cow of the Soudanese race (*G. c. typica*).

A very similar scene occurs in the almost contemporary tomb of Amunezeh. The animal is led by an attendant by means of a cord attached to its right foreleg, and, as before, a baboon clings to its neck, this time holding on to the animal's mane. The ground-colour is yellow, the spots small and black, and the frontal horn well developed. The artist has been here more observant, for the legs are

unspotted below the knee; the unspotted part of the legs, however, is uniform in colour with the rest of the body, whereas it should be white. This example is interesting, as the Egyptian name of the Giraffe, *mimi*, is written above the picture *.

Later still in the Eighteenth Dynasty we meet with the Giraffe again in the tomb of Huy, who was viceroy of Nubia in the reign of the now famous Pharaoh Tutankhamen. Here a captive Giraffe is shown led by two negroes in a scene which depicts the bringing of tribute from Nubia. The Giraffe in this instance is a very young bull, scarcely taller in stature than the men who lead it. The paired horns, which are slightly developed, are represented side by side (that is to say, full-face), although the head is drawn in profile—a well-known convention of Egyptian drawing (text-fig. 8). The immaturity of the animal is further denoted by the very slight development of the median horn. The picture has sustained serious damage, but from what remains it can be seen that the animal had a tawny ground-colour, with black spots, of which some traces remain on the neck. In the same tomb is the picture of a large gold epergne, adorned with scenes from Ethiopian life: and in this group two Giraffes are seen, browsing from the foliage of the trees, one of which I here reproduce (text-fig. 9). In these latter examples, the paired horns are fully developed and the median horn is absent, and, as the animals are considerably taller than the negroes who attend them, we evidently have before us two fully grown female animals of the Nubian race †.

On the walls of the temple built by Ramesses the Great (Nineteenth Dynasty), at Beit-el-Wali in Nubia, the Giraffe is once more depicted amongst the animals brought as tribute, in association with ostriches, monkeys, and other animals. The Giraffe, which is a very young bull, is scarcely taller than the man who leads it, and, although the paired horns are indicated, the median horn is omitted, as it is inconspicuous in young males. The ground-colour is yellow, and the markings are irregular blotches of reddish brown ‡.

Belonging to a later period of Egyptian history—that is to say, to the Saite or even to the Ptolemaic period—are two

* Max Muller, 'Egyptological Researches,' vol. ii. plate xxxi.

† The tomb of Huy has recently been published by Dr. Alan Gardiner. See especially his plates xxiii., xxvi., and xxvii. ('The Tomb of Huy, 1926).

‡ Arundale and Bonomi, 'Gallery of Egyptian Antiquities, pl. xxxviii.

little pottery figures in the Cairo Museum. Each of these represents a kneeling man with his arm passed about the neck of a couchant Giraffe. Either the animals represented are very young foals or the artist who made them had no sense of proportion *.

In the above representations of Giraffes from the Egyptian monuments it will have been observed that the majority are very young animals. The reason for this is obvious. They are being led as tame or captive animals, and are therefore much more docile than full-grown animals, which would not be easy to manage. For the moment I cannot call to mind any other examples than those to which I have already alluded, but it may be mentioned that the two long-necked animals represented on a slate palette (part of which is in the British Museum and the other portion at the Ashmolean Museum, Oxford) are often described as Giraffes. I believe, however, that they are long-necked gazelles. This palette is well-known and frequently figured in Egyptological books. As a hieroglyph, the Giraffe occurs as a syllabic sign with the value *ser*, in a word which means "to prophesy," "to foretell," etc. It would seem from this that the Egyptian name for Giraffe must originally have been *ser* †. At the time of the Eighteenth Dynasty, as we have seen, the Giraffe was called *mimi*, which may perhaps be a borrowed Nubian word. In the "Story of the Shipwrecked Sailor," a popular Egyptian tale of ancient date, at least as old as the Middle Kingdom, the mariner on leaving the enchanted island is laden with gifts, amongst which are mentioned "Giraffes' tails." The word for Giraffe here again is *mimi*. In this connection it is interesting to note that Giraffes' tails are much prized by several African races to this day. The Nubas of Kordofan, for instance, attach these tails to the horns of their sacred cattle as marks of honour. In the tomb of Huy, to which I have already referred, many of the negroes who bear offerings are carrying long tuft-like objects composed of wavy black hair. These are the tail-tufts of Giraffes, which were regarded as objects of great value.

Classical writers on natural history have singularly little to tell us concerning the Giraffe. Ælian and Aristotle do not mention it at all, but Pliny tells us that the animal was called *nabu* by the Ethiopians, that it has the neck of a horse, the legs and feet of an ox, the head of a camel, and

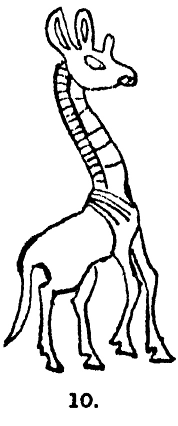
* Daressy, 'Annales du Service des Antiquités,' tome vii. 1906, pp. 61–66.

† See the examples in Brugsch, 'Worterbuch,' p. 1080.

that it has white (*sic*) spots on a tawny ground, whence its name *camelopardalis*. The first Giraffe seen in Rome was exhibited in the Circus by the Dictator Cæsar, after which it was seen from time to time. Pliny adds that it is an animal of remarkable appearance and very wild *. Diodorus Siculus gives a fantastic account of an animal which inhabits Arabia Felix, but his account seems to be a mixed jumble in which the attributes of several animals are confused, the Giraffe amongst the rest †.

ADDENDA.

In arranging the notes from which the above article was written, I inadvertently missed out two very early repre-



10.

sentations of the Giraffe which are of great interest, and these I now add. Both examples are incised upon slate

* 'Natural History,' book viii. ch. 27.
† 'History,' book ii. ch. 51.

palettes of pre-dynastic date. They are anterior to the First Dynasty (circa 3400 B.C.), and, considering their very early period, are wonderfully true to nature. The first (text-fig. 10) is from a slate palette from Hierakonpolis, and is now in the Ashmolean Museum, Oxford. The second (text-fig. 11) is from a similar palette in the Louvre. On one side of this object a palm-tree is depicted, with two giraffes and certain other animals heraldically arranged on either side of it. Good photographic reproductions of both these palettes will be found in the 'Proceedings of the Society of Biblical Archæology,' vol. xxxi. 1909, pls. xliii. and xliv.

EXPLANATION OF PLATE XV.

Giraffe from the tomb of Ukh-hotp at Meir. Reproduced by permission of the Egypt Exploration Society.

XLIX.—*On some new Collembola from Trinidad.* By C. H. N. Jackson, B.Sc., University Museum of Zoology, Cambridge.

The following descriptions of new Collembola were made from specimens in spirit brought from Trinidad by the late Dr. C. L. Withycombe. They were found in débris in the floor of a guacharo cave in the Oropuche Heights, consisting of the droppings of bats and of the guacharo birds which form the principal fauna of such caves. The débris of the sample was collected near water, and at a distance of approximately 200 yards from the cave-mouth. The Collembola occurred together with Coleoptera of all sizes, Isopoda, Acarina, and Pseudoscorpionida. The sample is dated 5th April, 1925.

Thirty-eight specimens, referable to six species, were recovered from the sample after an exhaustive search:—

Xenylla cavernarum, sp. n. 20 specimens.
Guacharia trinitata, gen. et sp. n. 3 specimens.
Proisotoma perparva, sp. n. 11 specimens.
Cyphoderus assimilis, C. B. (1906). 2 specimens.
Sinella, sp. indet. 1 specimen.
Lepidocyrtus (?), sp. indet. 1 specimen.

Many of the specimens were crushed or broken; and, owing to the small size of the majority, several more were lost or rendered useless during treatment with potash and

other reagents used in the process of identification. This was the fate of both specimens of *Cyphoderus assimilis*, C.B.; but adequate drawings had already been made of them, from which specific determination was possible. This species, under the name *C. simulans*, is recorded by Imms (1912) from similar cave-débris (bat droppings) in India.

Of the new species, two belong to pre-existing genera, and for the reception of the third the genus *Guacharia* is proposed, a discussion of the characters of which appears among the specific descriptions below.

I have been unable to obtain Kinoshita's paper (1916—Kinoshita, S., Dobuts. z. Tokyo, xxviii. p. 494), and am informed by the librarians of the British Museum that I shall not find it in any library in this country. The validity of my new species is, therefore, subject to confirmation by some authority acquainted with that paper.

The types and paratypes will be found in the British Museum. The type-specimen of *Xenylla cavernarum* having been treated with potash, it is recommended that recourse be had to the more visible paratypes, which are less likely to be lost. The specimens of *Guacharia*, on account of their comparative scarcity and small size, have been mounted on slides, and not left in tubes of spirit.

Order COLLEMBOLA.

Suborder ARTHROPLEONA, C. B., 1901.

Section **PODUROMORPHA**, C. B., 1913.

Family **Hypogastruridæ**, C. B., 1906.

Subfamily *HYPOGASTRURINÆ*, C. B., 1906.

XENYLLA, Tullb.

Xenylla cavernarum, sp. n.

Antennæ about equal in length to the head diagonal, their segments quite distinct, the distal two subequal. The terminal segment bears a number of short olfactory hairs and a rather elongated retractible end-bulb. The sense-organ on the third segment consists of two small mushroom-shaped projections and a pair of lateral bristles (fig. 9).

Eyes five on each side, placed as is usual in this genus.

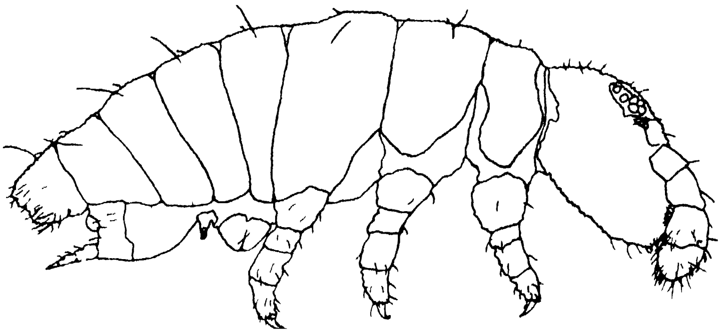
Post-antennal organ absent.

Mouth-parts of the usual Collembolan biting type, with mandibles well developed.

Body-segments distinct (fig. 8).

Claws of all pairs of feet with a median tooth situated in the distal half of the inner edge. Lateral teeth insignificant

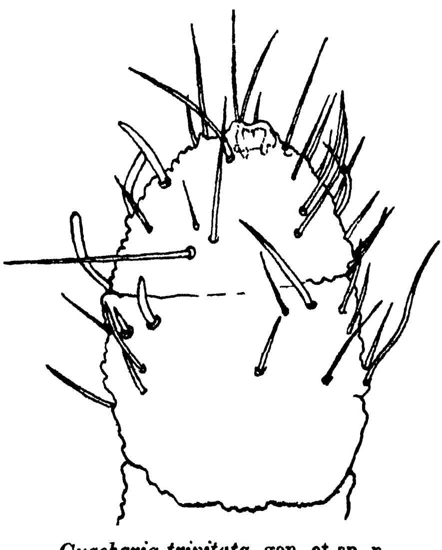
Fig. 1.



Guacharia trinitata, gen. et sp. n.

Whole animal from right side. × 230.

or absent. Empodial appendage absent. One median and one external tenent hair on each foot, about equal to the claw in length (fig. 10).



Guacharia trinitata, gen. et sp. n.

Terminal segments of right antenna from right side. × 1040.

Tenaculum present, three-toothed.

Furca moderately well developed. Mucro fused indistinguishably with the dens, the mucrodens bearing a single bristle on the dorsal side, and having a quite distinct outer lamella; the tip is slightly recurved (fig. 11).

Anal hooks present; small, almost straight, placed on small papillæ well separated at their bases (fig. 12).

Hairs of the body rather long, curved, always simple. Enlarged dorsal sensory bristles absent.

Fig. 3.

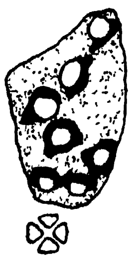


Fig. 4.

Fig. 5

Guacharia trinitata, gen. et sp. n.

Fig. 3.—Eye-patch and post-antennal organ. × 1040

Fig. 4.—Other forms of post-antennal organ. × 1040

Fig. 5.—Right hind foot, right side. × 1040.

Colour in spirit blue-grey, pigment scattered. Eyes on a dense black patch; an anchor-shaped black mark on the vertex of the head.

Length 0·65 mm.

The species does not appear to be closely related to any other member of the genus, the feet and mucrodens being very distinct.

Subfamily *Achorutinæ*, C. B., 1906.

Tribe PSEUDACHORUTINI, C. B., 1906.

Guacharia, gen. nov.

Guacharia trinitata, sp. n.

Antennæ shorter than the head, their third and fourth segments doubtfully distinct; the third segment slightly longer than the fourth. Olfactory hairs present. Retractile end-bulb present, rather short, at its tip bilobed. Sense-organ of the third segment rudimentary, consisting of a

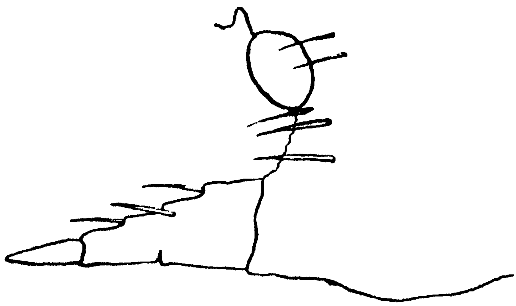
short pointed stylus on the outer side and. internal to it, a structure closely resembling a typical olfactory hair (fig. 2).

Fig. 6.

Guacharia trinitata, gen. et sp. n.
Dorsal integument of first abdominal segment, right side. × 1040.

Eyes seven on each side, the third ocellus being absent from the inner row. The eye-patch is placed slightly behind

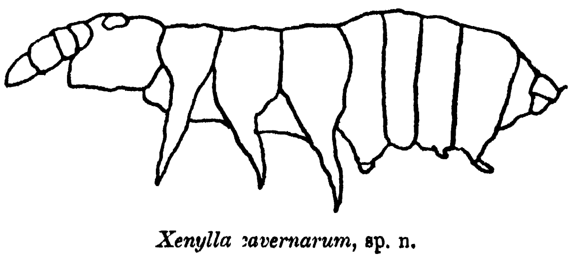
Fig. 7.



Guacharia trinitata, gen. et sp. n.
Furca from right side. × 1040.

the middle of the head, a condition ordinarily characteristic of the Poduridæ, C. B., 1913. The obliquely prognathous

Fig. 8.



Xenylla cavernarum, sp. n.
Whole animal from left side. × 108.

disposition of the mouth-parts, however, shows the present species to be a member of the Hypogastruridæ, C. B., 1906 (figs. 1, 3).

Post-antennal organs consisting of four or (usually) of five subtriangular structures arranged in a circle (figs. 3, 4).

Fig. 9.

Xenylla cavernarum, sp. n.
Terminal segments of left antenna; latero-dorsal aspect. × 760.

Mandibles absent. Lacinia of maxilla and the maxillula well developed and normal.

Fig. 10.

Xenylla cavernarum, sp. n.
Left fore-foot from left side. × 760.

Thorax almost equal to the abdomen in length, its segments fairly distinct (fig. 1).

Claw of each pair of legs with a tooth on the inner edge, rather nearer to the base than to the extremity. Lateral teeth not detected ; but the species is so small that they may, nevertheless, be present. Tenent hairs and empodial appendage absent (fig. 5).

Abdominal segments indistinctly separated, the fifth and sixth segments fused. The whole abdomen is rather reduced, tapering towards the hinder end (fig. 1).

Anal hooks absent.

Ventral tube small, placed close to the three-toothed tenaculum, the ventral side of the second abdominal segment being much reduced.

Fig. 11.

Xenylla cavernarum, sp. n.

Furca and tenaculum from left side. × 570.

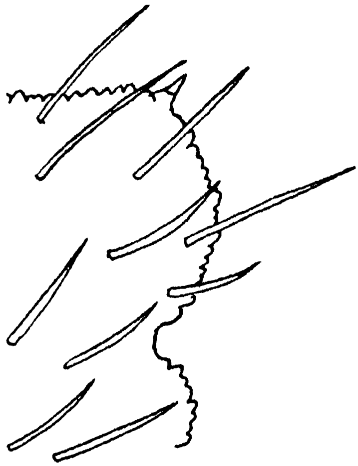
Furca well developed. Mucro, dens : manubrium = 1 : $2\frac{1}{2}$: $2\frac{1}{2}$ (measuring along the dorsal edge). Three bristles dorsally on the dens. Mucro fairly broad, simple, tapering regularly to the tip, its ventral side forming one straight line with the ventral edge of the dens. An oval thickened pad is present on the dorsal side of the manubrium (fig. 7).

Hairs of the body extremely sparse. Paired segmental dorsal sensory bristles occur on the meso- and metathorax, and on the first to the fifth abdominal segments, inclusive. Shorter hairs are found on each segment dorsally, including the prothorax, one pair to each segment. They also occur in larger numbers on the last segment of the body, on the

legs and furca, and on the head (fig. 6). The hairs of the antennæ are rather longer than the others, especially on the terminal segments. All the body-hairs are simple.

Colour in spirit light brownish grey, with very fine blue

Fig. 12.

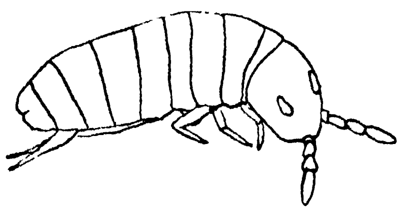


Xenylla cavernarum, sp. n.

Hind end of the body from left side. × 760.

dots on the head, antennæ, legs, manubrium, and back and sides of the thorax and abdomen. Eyes on separate black pigment-spots of irregular outline, set on a pale bluish eye-patch.

Fig. 13.



Proisotoma perparva, sp. n.

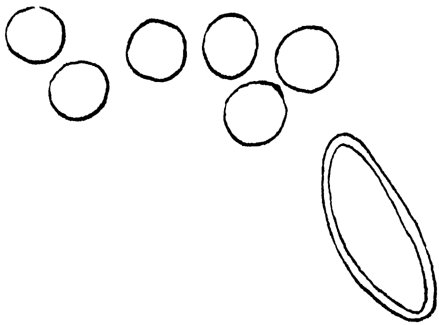
Whole animal from right side. × 108.

Length 0·4 mm.

The genus is characterised by the presence of seven eyes on each side of the head, the absence of the mandibles, and

the reduced abdomen. The backward situation of the eye-patch has been noted above. The genus *Gomphiocephalus*, Carpenter, also lacks the third ocellus of the inner row; but

Fig. 14.



Proisotoma perparva, sp. n

Eyes and post-antennal organ of right side. × 1840.

this genus is a member of the mandibulate Hypogastrurinæ, and is readily separable on other grounds from *Guacharia*.

Section **ENTOMOBRYOMORPHA**, C. B., 1913.

Family **Isotomidæ**, Schäff., C.B., 1903.

Subfamily *Isotominæ*, Schäff., C. B., 1913.

Proisotoma, s. str., C. B.

Proisotoma perparva, sp. n.

Antennæ about equal in length to the head diagonal, the fourth segment double the second or the third, which are subequal (fig. 18). The fourth segment bears an olfactory end-bulb, but no subapical sensory groove can be seen (figs. 15, 16). The sense-organ of the third segment is quite typical and is not surrounded by a chitinous ring (fig. 17). A few olfactory hairs are present on the terminal segments.

Eyes six on each side, their diameters subequal, the two proximal ocelli being quite absent.

Postantennal organ elongate, elliptical, its long axis two or three times as long as the diameter of an eye (fig. 14).

Mouth-parts of the normal Collembolan biting-type, the mandible with a typical molar plate.

Prothorax rather well developed, with a few minute hairs, a character apparently unknown hitherto in the Entomobryomorpha.

Fig. 15.

Fig. 16.

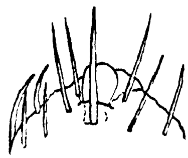


Fig. 17.

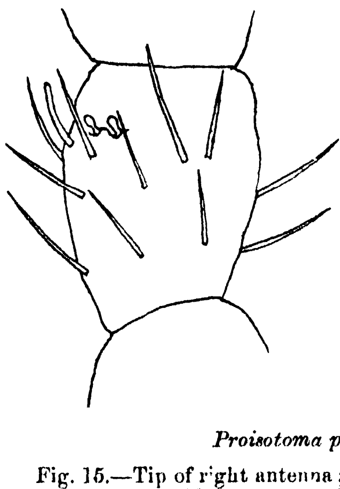
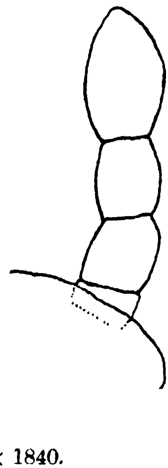


Fig. 18.



Proisotoma perparva, sp. n.

Fig. 15.—Tip of right antenna; dorsal aspect. × 1840.
Fig. 16.—Tip of left antenna; interno-lateral aspect. × 1840.
Fig. 17.—Third segment of left antenna; interno-dorsal aspect. × 1840.
Fig. 18.—Left antenna, dorsal aspect, showing relative lengths of segments. × 460.

Claw without teeth, the inner edge obtusely angulated near the base. Empodial appendage three-cornered as is usual in this genus, about half the length of the claw. Tenent hairs absent (figs. 19, 20).

Abdominal segments all distinct (fig. 13).

Furca rather short, not reaching to the ventral tube. Dens slightly longer than manubrium; manubrial hooks present. Mucro indistinctly lamellate, with terminal and

Fig. 19.

Fig. 20.

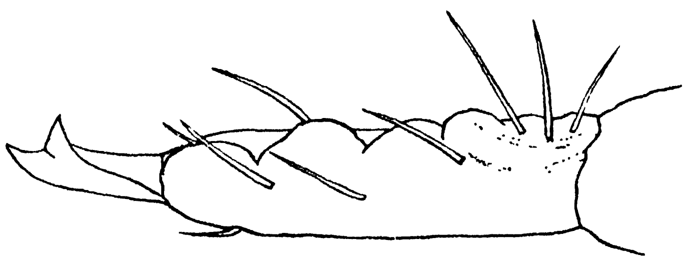
Proisotoma perparva, sp. n.

Fig. 19.—Left mid-foot, from left side. × 1840.
Fig. 20.—Left hind leg, from right side. × 460.

dorsal teeth. Dens not annulated; but the dorsal edge is raised into four or five rounded hillocks on the outer side (fig. 21).

Tenaculum with bristle, four-toothed.

Fig. 21.



Proisotoma perparva, sp. n.

Right dens and mucro from right side. × 1840.

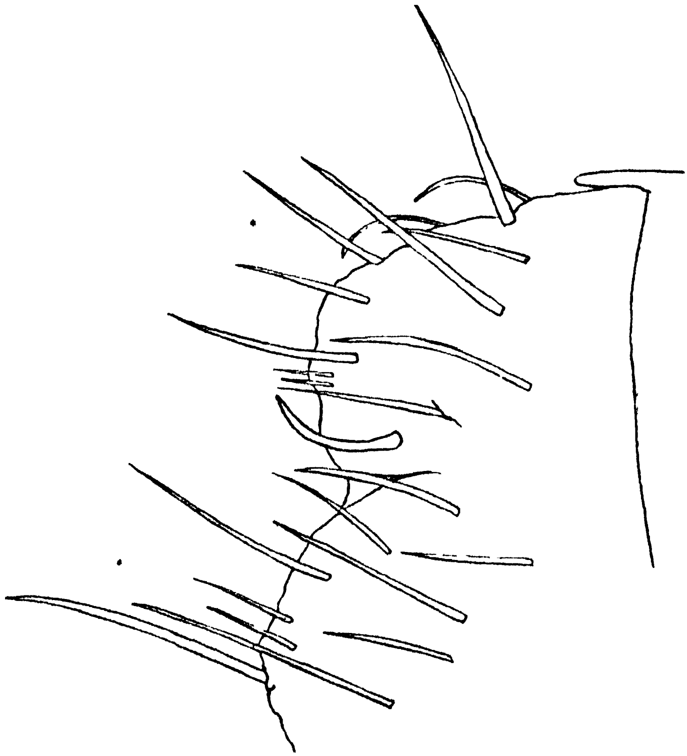
Hairs of the body of medium length, all simple. A pair of very stout, tusk-like, recurved anal bristles on the last segment (fig. 22).

Colour in spirit yellowish grey, with finely divided blue pigment.

Length 0·45 mm.; one or two examples rather larger.

Of the other species of this genus, *P. micrura*, C. B. (1907), shows the loss of the same two proximal ocelli, but is well distinguished from the present species by the form

Fig. 22.



Proisotoma perparva, sp. n.
Hind end of the body from right side. × 1840.

of its feet and mucrones. In *P. ultonica*, Carpenter (1911), the proximal ocelli are present but reduced ; in all other known species they are present and of normal size.

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L.—*Some Forms of* Cyclops *allied to* C. languidus, *Sars, with Notes on* C. minutus, *Claus.* By ROBERT GURNEY.

IN his great monograph of the fresh-water Copepoda of Germany (1892) Schmeil brought together all that was then known of the genus *Cyclops*, and laid a sure foundation for further advances ; but in his review of the species known to him he refused to admit to specific rank a number of forms whose claim has since been established. In this caution he was undoubtedly justified in most cases by the imperfect descriptions at that time available. His treatment of *C. nanus*, of which he had himself examined specimens submitted to him by Prof. Sars, as a synonym of *C. languidus* is, however, a little difficult to understand, since *C. nanus* is certainly a constant, well-marked, and widely distributed species which is now generally accepted. In addition, another closely allied species, *C. languidoides*, Lilljeborg, has been described, and also certain forms which are treated by Kiefer * as subspecies either of *C. languidoides* or of *C. nanus.*

* Int. Rev. Ges. Hydrob. Hydrog. 1926, xiv. pp. 341–370

During some collecting undertaken in 1920, in Norfolk and elsewhere, I noted, in addition to *C. nanus*, three other forms which, though closely allied to *C. languidus*, were evidently distinct from it and from any species or variety then described. These new forms are described below and are given new names, but this is done rather with a view to providing material for discussion of the limits of a species than with a full certainty that these are really specific entities. The additional forms here described are so far transitional between others already known that even the three species recognised tend to merge into one another. *C. languidus* appears to take rank with *C. strenuus* and *C. viridis* as a centre of radiation, around which are grouped a number of forms which may be regarded as either "varieties," "subspecies," or "species." There are many such cases, which raise the question of the meaning of a species and how far such variants may perhaps be products of their environment, and progress to their understanding seems only to be possible by "splitting" rather than "lumping" species, and eventually by experimental breeding.

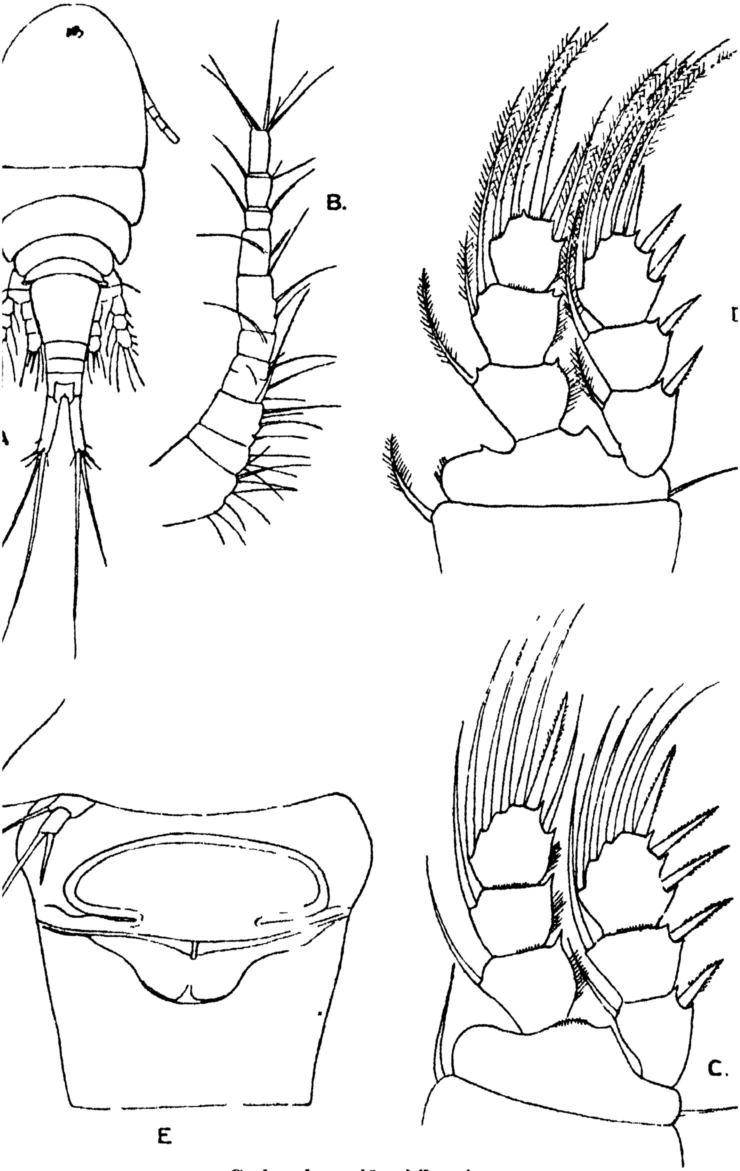
In the case of *C. languidoides* there are two possibilities:—(1) These subspecies have arisen by modification of the type-form *C. languidoides*. (2) They are not more nearly related to it than to *C. languidus*. If the first supposition is correct, these subspecies may, in a sense, be regarded as "glacial relicts." *C. languidoides* is a northern and arctic species, and, in its typical form, has not been found in central Europe. It may be that the species has lingered here and there in the lowlands, but has there broken up into "subspecies" characteristic of definite habitats. This is, of course, no more than a speculation, and takes no account of the obvious alternative that one of the subspecies may really be the parent form!

Having regard to the absence of the type from the region inhabited by the subspecies, the possibility has to be borne in mind that the *languidoides*-forms of central Europe may have been separately derived from *C. languidus*, and may therefore be related to each other only through a common parent species. The examples* of *Limnocalanus macrurus* and of *Mus rattus* in India teach a certain caution in assuming direct relationship between all populations of the same species.

Cyclops languidus hiberniæ, subsp. n. (Fig. 1.)

In Sept. 1920 a few specimens of a very distinct *languidus*-like form of *Cyclops* were found in a small puddle near the

Fig. 1.



Cyclops languidus hiberniæ.
A. Female, dorsal view. B. First antenna. C. Leg 3. D. Leg 4.
E. Leg 5 and receptaculum.

estuary of Malahide (Co. Dublin), and were recorded * as probably representing a distinct species; but I was not at the time prepared to form any definite opinion on the question without going fully into the relationship of the various forms of *C. languidus*.

Description.

Length.—Female, ·84–·91 mm.; male, ·72 mm.

General form as in *C. languidus*. Fifth thoracic somite with slightly upturned angles.

Genital somite—breadth about equal to length (66 : 64) and longer than succeeding three somites.

Furcal rami about eight times as long as wide (130 : 24); outer seta inserted near end (furca 130, position of seta 105). Outer spine slightly longer than inner seta (22 : 16).

First antenna 11-jointed, the relative length of the joints as follows:—

1	2	3	4+5	6	7	8	9	10	11
22	6	11	11	8	14	12	6	10	12.

The fourth and fifth joints are not clearly separated.

Legs as in *C. languidus*, but third joint of exopodite of leg 4 about as broad as long (14 : 13·5). Apical spines long —the outer spine a little shorter than the inner (16 : 22).

Basal joint of fifth leg distinct.

Genital operculum of male with three setæ.

This form differs from *C. languidoides* and *C. nanus* in its large size, in the well-developed basal joint of the fifth legs, and in the length of the furca combined with the presence of the lateral seta near the apex. On the other hand, it differs from *C. languidus* and resembles *C. languidoides* in the extreme shortness of the last joint of the fourth exopodite. In fact, this joint is shorter than in any *languidoides* forms. It should probably be regarded as a form of *languidus* rather than *languidoides*, but differs from it so strikingly in the 11-jointed antenna, shortness of the fourth exopodite, and greater length of the setæ of the third and fourth legs that it might be considered to have the same right to specific rank as *C languidoides* †.

Cyclops languidoides, Lilljeborg.

In a list of the Copepoda of East Norfolk published in 1904 ‡ I recorded as *C. languidoides* a *Cyclops* of the *languidus*

* 'Irish Naturalist,' Feb. 1921, p. 18.

† Willey (1925, Trans. R. S. Canada, xix. p. 141) has described a species, *C. languidulus*, which resembles *C. languidus*, but has eleven-jointed first antennæ. Unfortunately, the description given does not permit of comparison with the form here dealt with.

‡ Trans. Norf. & Nor. Nat. Soc. vii. p. 646.

group, which was found frequently on flooded marsh-land, where the ground was covered with a growth of *Hypnum*. There were certain obvious differences between this form and that described by Lilljeborg, but there was a general agreement, and it could certainly not be identified with any other species then known. A re-examination of the specimens then collected shows that this form should certainly be included in *C. languidoides*, although it holds a position rather intermediate between the type and var. *clandestinus*, Kiefer. It differs from the latter in the approximate equality of the terminal spines of the fourth endopodite and the proportion they bear to the length of the joint, and from the type in the short furcal rami and short fourth endopodite. A second distinct form has since been found, and is described below as *C. languidoides eriophori*.

Examination of Kiefer's table of measurements shows considerable variability in these forms, and the differences are in any case very small; but it seems best at present to describe and to name such forms, since they are certainly recognizable and appear to be definitely related to certain types of habitat, thus:—

C. languidoides, Lillj. N. Sweden and Murman Coast.
" *clandestinus*, Kiefer. Subterranean (?), in water-supply of Oefingen in company with *Bathynella*.
" *zschokkei*, Graeter. Caves in Jura Mts.
" *hypnicola*, subsp. n. Moss-bottomed marshes in Norfolk.
" *eriophori*, subsp. n. *Eriophorum*-marsh in Norfolk.

C. languidoides, Lillj., has been recorded by Klie from moor-pools at Bremerhaven, but Kiefer, who has examined his specimens, has found them to be typical *C. nanus*.

Cyclops languidoides hypnicola, subsp. n. (Fig. 2.)

Length.—Female, ·53 mm.; male, ·42 mm.

Genital somite longer than the rest of the abdomen (44 : 39) and nearly as wide anteriorly as long (44 : 39). Furcal rami relatively short, length about two and a half times the width (2·6 : 1). The lateral seta inserted in the distal third (furca 20, position of seta 13·5). Relative length of the furcal setæ as follows:—

outer	2	3	inner.
13	79	129	11

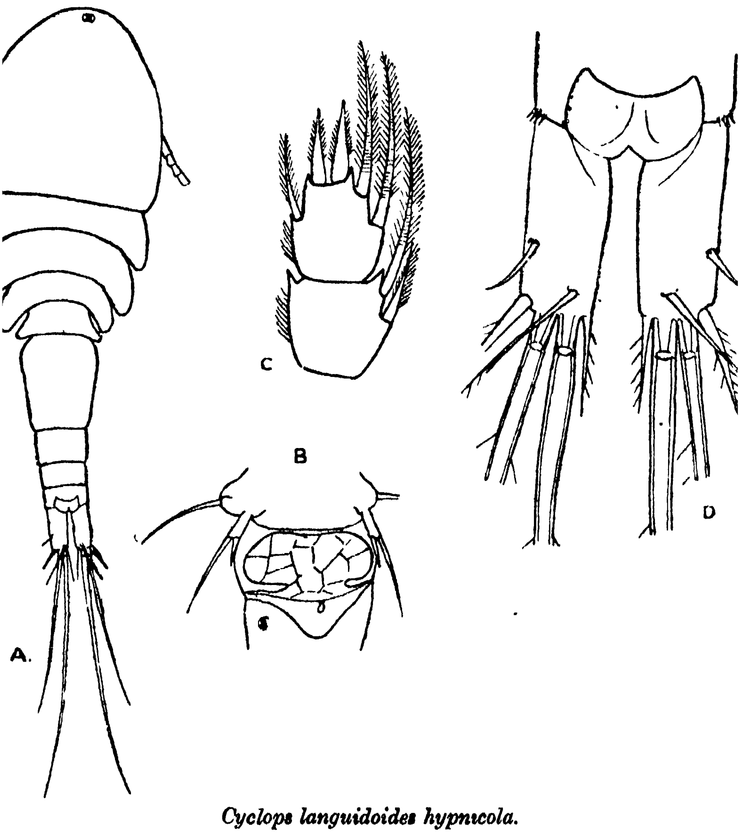
Owing to its delicacy the exact measurement of the inner seta is difficult, but it may be almost as long as the outer seta.

The relative length of the joints of the antenna is as follows :—

1	2	3	4	5	6	7	8	9	10	11
15·5	4·5	8	4·5	3	6	11	9·5	6	8	9

Leg 4—third joint of endopodite but little longer than wide.

Fig. 2.



Cyclops languidoides hypnicola.

A. Female. B. Receptaculum and fifth leg. C. Leg 4, second and third joints of endopodite. D. Furcal rami.

The proportion is slightly variable, but in a typical individual the proportion of length to width was 1·25 : 1.

The terminal spines are almost equal (inner 1·1, outer 1) and the joint is about once and a half as long as the

inner spine (1·4 : 1). The basal joint of the fifth leg is sometimes distinct, but is commonly fused with the somite. Receptaculum as in *C. languidus.*

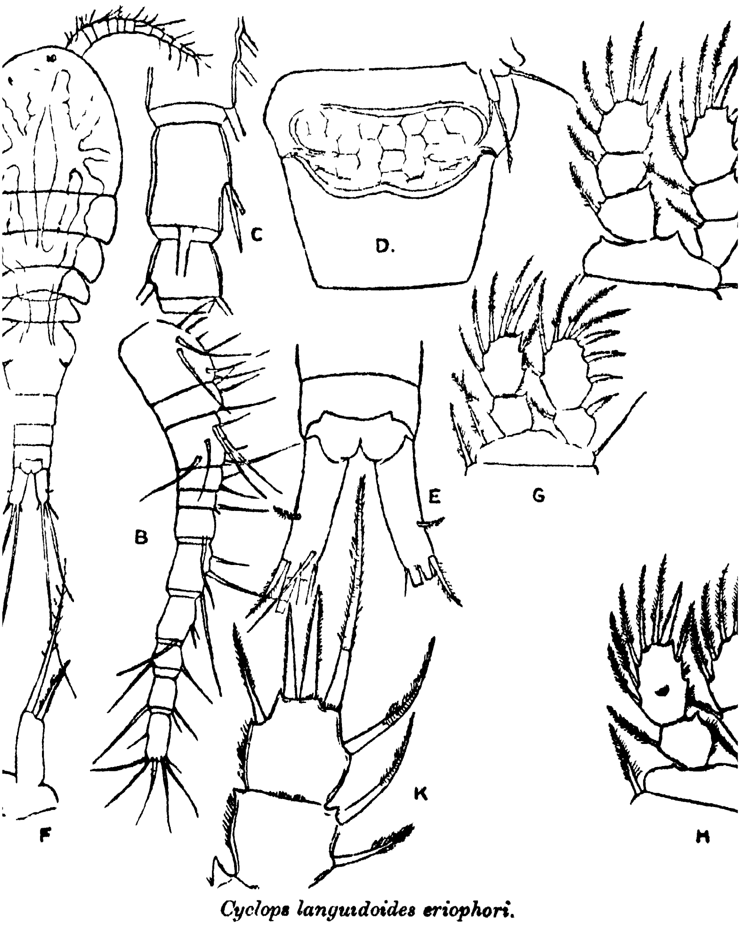
Cyclops languidoides eriophori, subsp. n. (Fig. 3.)

Length ·59–·7 mm.

Colour whitish.

Genital somite short, the length about equal to width

Fig. 3



Cyclops languidoides eriophori.

A. Female, dorsal view. B. First antenna. C. First antenna, joints 7–9 D. Receptaculum seminis. E. Furcal rami. F. Fifth leg. G. First leg. H. Second leg. I. Third leg. K. Eudopodite of fourth leg.

(19 : 20), much broader in front, and greatly exceeding the length of the succeeding somites. Furcal rami often very divergent, the length three to three and a half times the width. Lateral seta inserted in distal third (furca 18, position of seta 13). Outer apical seta twice the length of the very slender inner seta (9 : 4·5); proportional length of middle setæ 1 : 1·7. The longest seta is about half the length of the body.

First antenna 11-jointed, the length of the joints as follows :—

1	2	3	4	5	6	7	8	9	10	11
10·5	4·9	9·5	4·5	3·5	6·5	11·2	10·2	7·5	7·2	8·2.

Fourth leg, second joint of endopodite with two setæ, of which the proximal is about two-thirds as long as the distal. Joint 3 as broad as long. Terminal spines—the inner spine longer than the outer (1·2 : 1) and a little shorter than the joint (1 : 1·06).

Basal joint of fifth leg usually distinct. Distal joint with spine and seta as in *C. languidus*.

This form has a most perplexing resemblance to *C. languidoides* and its variants, but agrees with none of them. In life its white colour and general form are quite distinctive, but the structural features which distinguish it are small :—

(1) Form of genital somite.
(2) Divergence and form of furca.
(3) Shortness of innermost furcal seta.
(4) Form of receptaculum.
(5) Shortness of last joint of fourth endopodite.

I have met with this form in one place only—namely, on a marsh in the parish of Ingham, which is flooded only in winter and spring and is usually dry in summer. The soil is a "sour" peat covered with a tangled growth of *Eriophorum*, amid which are small, very shallow, pools of water. The *Cyclops* is found among the decaying leaves of *Eriophorum* in these puddles.

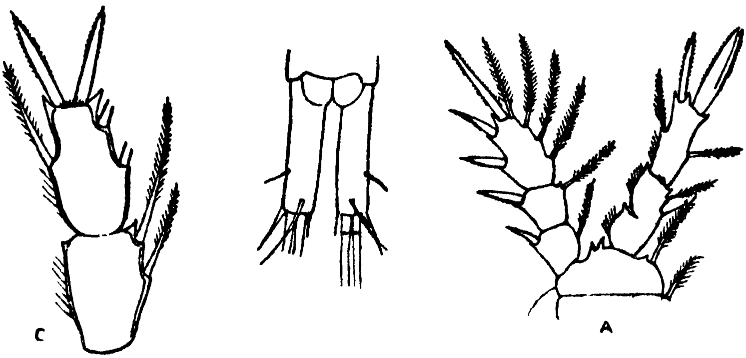
Cyclops nanus, Sars.

Syn. *Cyclops diaphanus*, Sars, Crust. Norway, v. 1918, p. 52.

Kiefer (1926) has given figures of this quite distinct species, and distinguishes within it a "subspecies" *C. nanus incertus*, Wolf, and a "forma" *C. nanus diaphanoides*,

Graeter; but it appears that the distinction of these two forms is based solely on the degree to which the basal joint of the fifth foot is free. The distinction seems to be quite unworkable, since within the same population may be found individuals in all stages of suppression of this joint. In some specimens, for instance, from Sutton Broad in Norfolk, the basal joint is entirely distinct—as much so as in *C. languidus*,—while in others it is free only at its outer angle, and in others again no trace at all could be seen, the outer seta appearing then to spring from the angle of the somite itself. The difference, therefore, does not correspond to any difference of habitat and is merely of the order of individual variation.

Fig. 4.



Cyclops nanus.

A. Abnormal fourth leg. B. Furcal rami of abnormal specimen. C. Endopodite of fourth leg of same specimen.

In examining a large number of Norfolk specimens I have come across two abnormalities which are worth recording.

The first is a specimen having the endopodite of the fourth leg on the left side, as shown in fig. 4 A. The first and second joints are partly fused, the first lacking its inner seta, while the third not only has one inner seta only instead of two, but has also the inner terminal spine partly cleft into two. A further very unusual feature is the presence of an inner seta on the basipodite, such as is only found normally on the first leg, and of two spines between the rami instead of one. The leg of the opposite side was normal.

The second instance of abnormality is a specimen which differs from the type in two characters, and in both of them approaches *C. languidoides*. The furcal rami are rather shorter than usual, the length four times the width, and have the lateral seta inserted nearer the end than in the type (furca 20, position of seta 14) (fig. 4 B).

The last joint of the fourth endopodite is also shorter than is normal, the width being more than half the length (1 : 1·81 as compared with 1 : 2·4) (fig. 4 C). The spines are also shorter and about equal in length. Usually the inner spine is the longer, and it is longer than the joint, whereas in this case it is considerably shorter (15 : 20).

A further small difference is the greater length of the proximal seta of the second joint. Generally it is merely a small hair in *C. nanus*.

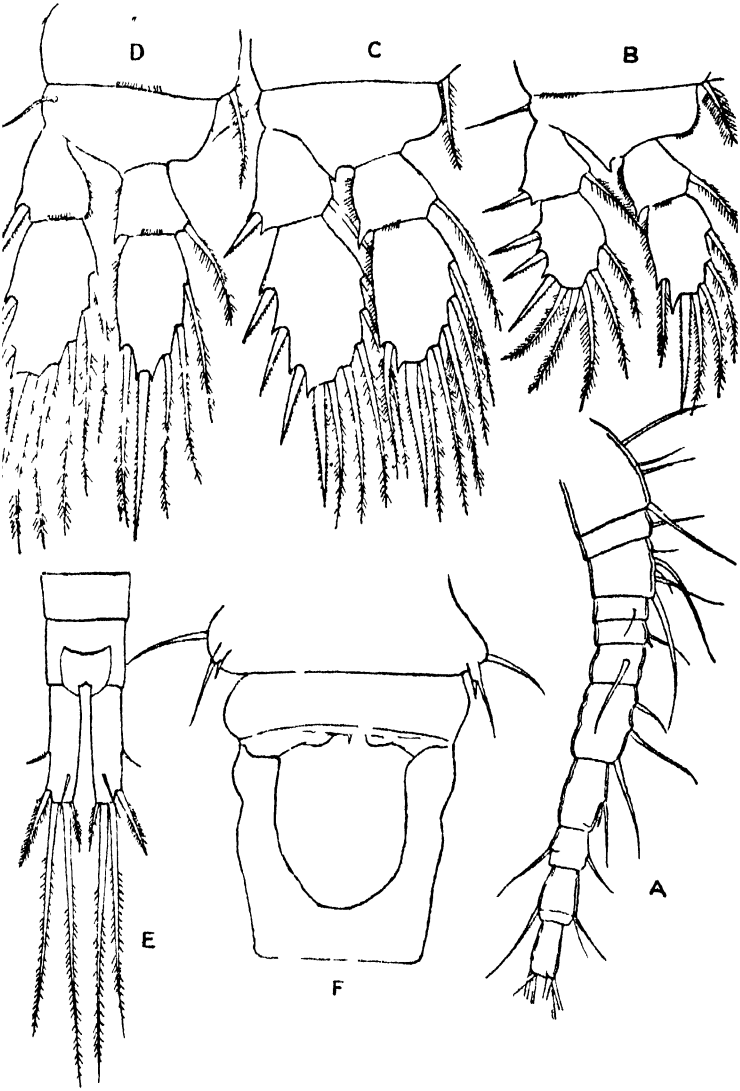
This specimen might, in fact, almost equally well be referred to *C. languidoides* as to *C. nanus*, and illustrates the difficulty in dealing satisfactorily with this group of variable species.

Cyclops minutus, Claus. (Fig. 5.)

Cyclops minutus, Claus, 1863, Die freilebende Copepoden, p. 102.
Cyclops diaphanus, Barrois, 1888, Azores.
Cyclops longicaudatus, Brady, 1891, Trans. North. & Durham, xi. p. 23.
Cyclops diaphanus, Blanchard & Richard, 1891, Mém. Soc. Zool. France, iv. p. 55; Landé, 1892, Mém. Soc. Zool. Fr. v. p. 167; Schmeil, 1892, Deutsch Süsswasser Copepoden, i. p. 112; Richard, 1893, Rev. Biol. Nord France, v. p. 6; Claus, 1894, Arb. Z. Inst. Wien, xi.; Scourfield, 1903, Journ. Quek. Mic. Club, (2) viii. p. 535; Van Douwe, 1903, Zool. Anz. xxvi. p. 550; Wolf, 1905, Zool. Jahrb. xxii. p. 171; Chickoff, 1906, Zool. Anz. xxxi. p. 80; Gurney, 1907, Rec. Ind. Mus. p. 32; Gurney, 1909, Journ. R. Mic. Soc. p. 294; Van Douwe, Süsswasserfauna Deutschlands, Copepoda, p. 36; Van Douwe, 1914, Copepoden—Deutsch Südwestafrikas; Chappuis, 1922, Zool. Anz. lv. p. 28; (= *C. minutus*), Gurney, 1921, J. Bombay N. H. Soc. xxvii. p. 90.
Cyclops minutus, Thallwitz, 1922, Zool. Anz. liv. p. 266; Kiefer, 1924, Zool. Anz. lviii. p. 278; Kiefer, 1926, Int. Rev. Hydrob. xiv. p. 356.

The original diagnosis of *C. diaphanus*, Fischer, is totally insufficient and applies equally well to either *C. nanus* or to *C. minutus*, Claus. None the less the descriptions given under this name by Schmeil (1892) and Claus (1894) define an easily recognizable species about which there could, one would think, be no possible confusion. The name was accepted in this sense until 1901 when Lilljeborg transferred it to the species previously described as *C. nanus*.

Fig. 5.



Cyclops minutus, Claus.

A. First antenna. B. Leg 1. C. Leg 2. D. Leg 4.
E. Furcal rami. F. Receptaculum

Lilljeborg's action is the more remarkable in that he cites as a synonym Claus's *C. minutus*, to which his own species has little resemblance. Unfortunately, his example has been followed by Prof. Sars, whose great authority has led to the application by others of the name *diaphanus* in the new sense. Kiefer (1926) has fully discussed this point and has reached the conclusion that this name, applied to two totally distinct species, should forthwith be dropped. This is the only course to take, and the two species should be known as *C. minutus*, Claus, and *C. nanus*, Sars.

Records of *C. diaphanus* in older literature are often doubtful and in some cases certainly refer to *C. bicolor*. The list of references given above are such as I believe to refer definitely to *C. minutus*. In some cases, where the nature of the locality in which the species has been taken is given, it is possible to arrive at some degree of certainty even in the absence of figures or information as to structure. *C. minutus* is a relatively large species characteristic of small temporary pools of muddy water, in contrast to *C. nanus* and *C. bicolor*, which inhabit clear water, the former usually in shallow water over a bottom of moss. If these records are accepted, the distribution of *C. minutus* is as follows:—

England: Salisbury (*Brady*), Norwich (*Scourfield*), Stalham (*Gurney* *).
Germany: Cassel (*Claus*), Würtemburg (*Wolf*).
Bohemia (*Mrazék*).
Poland (*Landé*).
Bulgaria (*Chikoff, Van Douwe*).
Syria and Palestine (*Richard, Gurney* *).
India: Orissa (*Gurney*), Lahore (*Gurney* *).
Mesopotamia (*Gurney*).
Algeria (*Blanchard and Richard, Gurney*).
Cyrenaica (*Gurney* *).
Egypt: Kabret (*Gurney* *).
Sinai (*Chappuis*).
S. Africa (*Van Douwe*).
Azores (*Barrois*).

As the list above shows, I have met with this species frequently, and, in every case where information has been available, it has been taken in temporary pools. In case my

* Records not previously published.

identification may be called in question, I give figures taken from an English specimen (Brunstead near Stalham, in Norfolk).

There are two characters of this species which are not alluded to by Kiefer in his description of S.W. African and Syrian specimens which should be mentioned. Firstly, in none of the specimens which I have examined (Palestine and Algeria) is there a seta on the inner side of the basipodite of the first leg. This seta is present in all other European species, except *C. leuckarti*, Claus, and in the great majority of the Cyclopoida as a whole (see Sars, Crust. of Norway, vi.).

Secondly, the cuticle of the abdomen and furcal rami usually shows very distinct ridges (or pits?). These markings are shown in Claus's figures, and similar markings are to be seen in some other species of *Cyclops*—e. g., *C. venustus*, *C. vernalis*, *C. dengizica*,—but not in any of the *languidus* group.

As to the position of the species within the genus: A reduction of joints in the legs and antennæ is not a reliable character on which to base relationship, and the characters of the fifth foot and receptaculum seem to afford a better foundation. Kiefer quite rightly excludes it from the *languidus* group, and it is also not to be related to *C. gracilis*, which Prof. Sars has shown to belong to the *leuckarti* group. *C. minutus*, in fact, seems to form the type of a group of its own, in which should be included *C. planus*, Gurney (syn. *G. halepensis*, Chappuis, *C. croaticus*, Krmpotic), *C. necessarius*, Kiefer, and *C. arnaudi*, Sars. To this group Claus's subgeneric name *Microcyclops* might be attached, although three of the species which he included in it (*C. gracilis*, *C. varicans*, *C. bicolor*) must be excluded.

LI.—*On the Titi Monkeys of the* Callicebus torquatus *Group.* By OLDFIELD THOMAS.

THE British Museum has received from Herr Ehrhardt some further specimens of the beautiful monkeys of the *Callicebus torquatus* group, the Yellow-handed Titis, and I have now had an opportunity of studying them.

In 1914* I described a monkey of this group, accepting for the time being the recognition of the red-bellied and black-bellied forms (respectively *torquatus* and *lugens*) as distinct species, to which I added a third under the name of *lucifer*.

But the additional material now available tends to show the essential unity of all the Yellow-handed Titis, and I should now propose to consider them as belonging to one species only, whose name would be *C. torquatus*, and to recognize among them five subspecies, each of which appears to be very constant in colour locally.

These subspecies may be arranged as follows:—

A. Under surface and inner aspect of thighs deep rufous.
  a. Back uniform dark chestnut-reddish. Tail-hairs mixed reddish and black .... 1. *C. torquatus torquatus*, Hoffm. Lower Rio Negro and Lower Solimoes.)
  b. Back grizzled greyish, the hairs ringed with black and buffy. Tail as in *torquatus* .... 2. *C. t. purinus*, subsp. n. (Lower Purus, S. of Solimoes.)

B. Under surface and inner aspect of thighs smoky or blackish.
  a. Tail absolutely black.
    a^2. Back uniform black or suffused with reddish. Crown dark chestnut .... 3. *C. t. lugens*, Humb. (synn. *amictus*, Geoff., *vidua*, Less.). (Upper Rio Negro.)
    b^2. Back grizzled brown, the hairs ringed blackish and buffy. Crown deep ochraceous, contrasting with back .. 4. *C. t. regulus*, subsp. n. (Upper Solimoes.)
  b. Tail dark red; back and crown also uniformly dark reddish .... 5. *C. t. lucifer*, Thos. (Rio Iça and Loreto district.)

Owing to the brevity of the description, the loss of the type, and the absence of an exact locality, it is quite impossible to identify Geoffroy's *C. amictus*, but it has previously been considered as a synonym of *C. lugens*, and may well be left in that position. *C. vidua*, Less., is certainly also a synonym of the same species.

* Ann. & Mag. Nat. Hist. (8) xiii. p. 345.

Further details of the new forms :—

Callicebus torquatus purinus.

Back finely grizzled brown, the hairs ringed with blackish and dull buffy, the whole effect rather more tending to rufous than in *regulus*. Hairs of crown deep rich chestnut, contrasting with the back. Under surface dull smoky reddish, the red becoming more intense posteriorly, the inner aspect of the thighs rich chestnut-rufous. Throat-patch comparatively large. Forearms and feet black; hands yellow. Tail with an intermixture of reddish hairs among the black, as in *torquatus*.

Dimensions of the type :—

Head and body 460 mm.; tail 510; hind foot 95.

Skull: greatest length 68·5.

Hab. of type. Ayapua, Lower Purus River, S. of Solimoes.

Type. Adult male. B.M. no. 26. 5. 5. 21. Original number 140. Collected 11th May, 1925, by W. Ehrhardt. One specimen.

Callicebus torquatus regulus.

Back finely grizzled brown, the hairs ringed with blackish and dull buffy. Hairs of crown, behind the black parts of the face, with rich ochraceous ends, making a coronal patch in marked contrast with the brown back. Under surface smoky blackish, the white throat-patch unusually large and conspicuous. Forearms black, hands yellow; inner side of lower legs black and feet black. Tail wholly black, without any intermixture of reddish hairs.

Dimensions of the type :—

Head and body 450 mm. ; tail 440 ; hind foot (wet) 97.

Skull: greatest length 68.

Hab. of type. Fonte-Boa, Upper Solimoes.

Type. Adult female. B.M. no. 27. 3. 6. 8. Original number 432. Collected 5th August, 1926, by W. Ehrhardt. One specimen only.

Readily recognizable by its grizzled brownish back and contrasted ochraceous crown, just as is *C. t. purinus* among the red-bellied forms.

LII.—*Description of a new Race of Aardvarks* (Orycteropus afer kordofanicus). By Lord ROTHSCHILD, F.R.S.

NEAREST to *O. afer æthiopicus* in its slenderer build and longer legs and tail. General colour of the pelage deep chocolate-brown, face and legs scarcely perceptibly darker; anterior half of tail white.

Adult, Kordofan.

Type in Tring Museum.

LIII.—*On the Skull of* Gorilla gorilla halli, *Rothsch.* By Lord ROTHSCHILD, F.R.S.

THE skull of *G. g. halli* is at once distinguished from that of *G. g. gorilla* by the great width of the occipital region and flat, not pointed, summit of the crista sagittalis. This subspecies is most interesting because it has the very wide flat-topped occipital region of the skull found in the "mountain gorilla" (*Gorilla gorilla beringeri*), whereas externally it has the shorter pelage and general characters of *G. g. gorilla* and *G. g. matschiei.*

Width of occipital region across the foramen magnum: ♂ skull no. 2, 138 mm.; ♂ skull no. 3, 168 mm.

Spanish Guinea (*A. J. Barnes coll.*).

MISCELLANEOUS.

Butterflies from N.W. Yunnan: a Correction.

FINDING that the name *wardi* (Ann. & Mag. Nat. Hist. ser. 9, vol. xix. p. 316, line 5 from top) is preoccupied in *Melitœa* for a form of an American species, I substitute *baileyi* for it here. The pair taken by Bailey will be types, Ward's ♀ the paratype.

H. T. G. WATKINS.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 113. MAY 1927.

LIV.—*Revision of the Genus* Tricyclea, *Wulp* (Calliphoridæ, *Diptera*). By C. H. CURRAN, Entomological Branch, Ottawa, Canada.

VAN DER WULP erected the genus *Tricyclea* in 1884 for the reception of a single species, *ferruginea*, from Africa. In 1908 Bezzi described two African species in the genus, but Villeneuve later placed them in his genus *Paratricyclea*. In 1921 Villeneuve added four species to the genus, so that at the present time we have the following species referable to *Tricyclea*:—

evaneda, Vill. Trans. Ent. Soc. London, p. 519 (1921).
ferruginea, Wulp, Bull. Soc. Ent. Belge, xxviii. p. ccxciv (1884).
perpendicularis, Vill. Trans. Ent. Soc. London, p. 522 (1921).
semithoracica, Vill. *op. cit.* p. 520.
verticella, Vill. *op. cit.* p. 521.

The species of *Tricyclea* are small robust flies, the colour almost always chiefly rusty reddish or yellowish; the abdomen is short, sub-rotund, and deep; arista moderately long to long-plumose, the lower rays somewhat shorter than the upper; facial depression moderately deep; oral vibrissæ very little above the anterior oral margin; facial ridges with bristly hairs on the lower half; parafacials usually more or less hairy, at least above, but the hairs are very

short and fine and often difficult to perceive; eyes of male usually closely approximated on the front; frontal bristles not strong, confined to the lower two-thirds in the male; orbitals not strongly differentiated from the frontals in the female; ocellar bristles varying from moderately strong to absent; outer verticals absent in the male. Thorax with three pairs of presutural (anterior) acrostichals; four (or three) pairs of post-sutural dorso-centrals; two sterno-pleurals; three or four pairs of marginal scutellars and a weak discal pair; median portion of the propleura hairy. Legs moderately strong. Abdomen with more or less well-developed, rather decumbent, apical bristles on segments 2 to 4 and, at least laterally, some discals on the fourth segment. Wing-venation as in fig. 5, the third vein bristled for at least two-thirds the distance from the base to the small cross-vein above and usually almost as far below. The thick basal portion of the first vein lacks hairs or bristles posteriorly.

The new genus *Tricyclodes* differs from *Tricyclea* by the absence of any hairs on the median portion of the propleura, *i. e.*, in front of and below the prothoracic stigma. As it is possible that one or more of the species described by Villeneuve belong to *Tricyclodes*, I have included all the species in a single key.

While the characters used in the key are apparently trivial, in some cases they are generally quite constant, the only variation found being in the width of the black dorso-central vittæ of the thorax, a character which it is necessary to use owing to lack of material in the previously described species. The male genitalia offer excellent characters for the separation of the species, and views of portions of this organ are given.

In the drawings of the wings the position of the veins may not be entirely accurate, owing to variation in drying. The drawings of the male genitalia are as this organ appears after being drawn out from the abdomen. In some cases the posterior forceps may be spread, giving a quite different appearance, although the outline of the arms of the forceps will remain the same. The outer forceps are evidently not always highly chitinized, and may therefore be somewhat curved or distorted. In making the drawings showing the posterior forceps a dorsal view is given, although the surface drawn lies beneath the abdomen and is ventral *in situ*.

Paratypes of the following species are deposited in the

British Museum of Natural History: *T. bivittata, palliventris, pallens,* and *difficilis.* The types of the South African species are in the collection of Mr. H. K. Munro and of the Congo species in the American Museum of Natural History, New York. The types of the four species described by Villeneuve are in the British Museum of Natural History.

Table of Species of Tricyclea *and* Tricyclodes.

1. Three posterior dorso-central bristles ..	*verticella*, Vill.
Four posterior dorso-centrals	2.
2. Wings hyaline, with or without costal spine	3.
Costal region with one or more brown spots or wholly brown	8.
3. Fourth abdominal segment either with a dark median vitta or wholly reddish or brownish and reddish, never with sharply defined apical spots	4.
Fourth abdominal segment with an apical black spot on either side......	6.
4. Costal spine strong, mesonotum almost wholly black, cinereous pollinose; propleura with fine hairs	*palliventris*, sp. n.
Costal spine very weak or absent; mesonotum chiefly pale; propleura bare on middle portion....................	5.
5. Ocellar bristles normally well developed; metanotum and mesonotum usually wholly pale; outer genital forceps about half as broad as long; disc of scutellum wholly pale	*Tricyclodes difficilis*, sp. n.
Ocellar bristles not differentiated; metanotum broadly black on either side; outer genital forceps three times as long as wide; disc of scutellum with brown tinge	*Tricyclodes pallens*, sp. n.
6. Abdominal segments 2 and 3 with median, rounded, apical black spot and lateral brownish fasciæ; fourth segment with two round black apical spots	*ferruginea*, Wulp.
Abdomen with entire, medianly broadened posterior black fasciæ on segments 2 and 3 and transverse apical spots on segment 4	7.
7. Thorax with a median dark vitta lying between the dorso-central bristles ..	*evaneda*, Vill.
Thorax with two (sometimes geminate) dark vittæ lying outside the acrostichal bristles	*latifrons*, sp. n.
8. Mesonotum black behind the suture, with the broad lateral margins pale..	9.

Mesonotum chiefly pale behind the suture	11.
9. Wings with two brown spots	10.
Wings with only one brown spot on the apical half	*unipuncta*, sp. n.
10. The post-sutural black area is produced forwards to the anterior margin of the thorax and extends outside the dorso-central bristles	*distigma*, sp. n.
The presutural black vitta extends forwards between the acrostichal bristles.	*perpendicularis*, Vill.
11. Third and fourth abdominal segments mostly black	*semithoracica*, Vill.
Fourth segment with transverse brown apical spot on either side	12.
12. Brown costal region broken into two spots; parafacial hairs in two rows .	*nigroseta*, sp. n.
Brown costal region entire or indistinctly interrupted; parafacial hairs in a single orbital row	*bivittata*, sp. n.

Tricyclea palliventris, sp. n.

Thorax, abdomen, and occiput cinereous or grey pollinose; thorax black, the humeri, posterior calli, and the scutellum, except its base, pale yellowish. Length 6·5 mm.

Female.—Head, except the upper two-thirds of the occiput, reddish yellow, a triangular vertical spot of yellow reaching to the neck; frontal vitta rather orange, the head elsewhere with yellowish-tinged pollen; eight pairs of rather fine frontals, the upper pair reclinate, the next pair proclinate and a little outside the frontal row; a row of short black hairs outside the frontals and two rows of tiny yellow or black facial hairs extending almost to the lower edge of the eyes. Front with parallel sides, three-fifths as wide as one eye, the sides strongly diverging in front; parafrontal one-third as wide as the median vitta; ocellar tubercle and the sides opposite more or less brown. Two rows of black hairs behind the eyes; cheeks with black hair, the oral row of bristles well developed; facial ridges with sparse, weak, bristly hairs on the lower half. Palpi, proboscis, and antennæ reddish, the third segment of the latter somewhat darkened; arista brown, with long brown rays. Ocellar bristles well developed; outer verticals almost as strong as the verticals.

The mesonotum bears three narrow, obscure, dark vittæ; four pairs of posterior dorso-centrals; two sterno-pleurals. Scutellum broadly blackish basally, except at the sides. Pile of the pleura partly black on the meso-, sterno-, and pteropleura.

Coxæ and legs reddish yellow, the tarsi becoming brown apically; posterior femora with a large irregular brown spot in front on apical half.

Wings cinereous hyaline; third vein with strong sparse bristles on basal three-fourths. Squamæ and halteres whitish, the latter with yellow knob.

First abdominal segment with the base in the middle, narrow median vitta, and slender posterior margin black or brown; second with apical fourth and broad median vitta black, the third segment black above except for a pair of broadly separated basal triangles, which occupy less than the basal half of the segment laterally; fourth segment pale except for a narrow median black vitta. In some lights there appears to be a slender median vitta devoid of pollen. On the under side the black bands are much narrowed and do not reach the inner ventral margins of the tergites or do so only obscurely.

Type ♀, Barberton, 2nd May, 1913 (*Munro*), and four additional females from the same place, May, August, and October 1913 and 1919, one collected by Mr. L. S. Hulley, the others by Mr. H. K. Munro.

In this species the costal spine is quite strong and the yellow squamose setulæ on the lower posterior edge of the hind tarsi extend along three segments.

Tricyclea latifrons, sp. n. (Figs. 1 & 2.)

Readily distinguished by the broad front of the ♂, the eyes being separated by two or three times the width of the ocellar triangle; legs entirely yellow; wings cinereous hyaline; thorax moderately cinereous pollinose, with two broad, posteriorly tapering, blackish vittæ, which extend to slightly inside the acrostichal bristles in front of (but lie wholly outside) the dorso-central bristles behind the suture and do not reach the posterior margin. Length 6·5 to 7 mm.

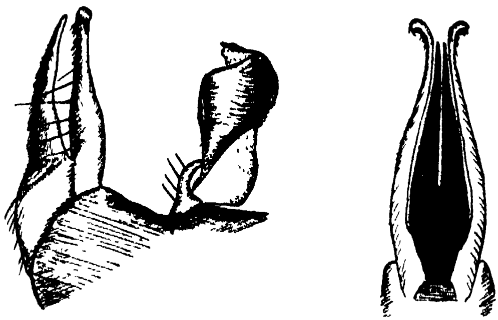
Male. — Head pale yellowish, a large subtriangular blackish spot on either side of the occiput above the middle; head, except the pale yellow frontal vitta, whitish pollinose. Parafrontals narrow above, widened below; six or seven pairs of frontals on the lower three-fifths, these becoming weak above; parafacials with only one or two obscure tiny hairs; ocellar and vertical bristles strong. A large triangle on the posterior part of the cheeks is pale-haired, the facial ridges with short bristly hairs on the lower half. Palpi and proboscis yellow; antennæ pale orange; arista brownish yellow, with black rays and apex.

The black vittæ extend over the anterior margin of the mesonotum between the acrostichal and dorso-central bristles, and there is a corresponding anterior projection of the pale colour behind, so that inwardly the black is produced somewhat and outwardly it extends as far as the second of the posterior dorso-central bristles. Each of the pleurites is stained with brownish in the middle; pleural pile wholly pale, except for a few black hairs on the upper portions of the meso- and pteropleura.

Squamæ and halteres yellowish; third wing-vein with bristles from the base almost to the small cross-vein.

Abdomen rusty yellowish, the fourth segment thinly greyish pollinose; second segment with less than the

Fig. 1. Fig. 2.



Tricyclea latifrons, sp. n.

Fig. 1.—Lateral view of ♂ genitalia.
Fig. 2.—Dorsal view of posterior and outer forceps of ♂.

apical fourth black, but the black colour is produced forwards as a narrow median triangle; third segment with the black fascia a little wider than that on the preceding segment. Fourth segment with a pair of elongate-oval, transverse, broadly separated, apical black spots. Lobes of the fifth sternite pale. Outer forceps divergent and enlarged at the apex.

Described from two males taken by Mr. H. K. Munro at Prospect, South Africa, on 18th March, 1923.

Tricyclea unipuncta, sp. n. (Figs. 3 & 4.)

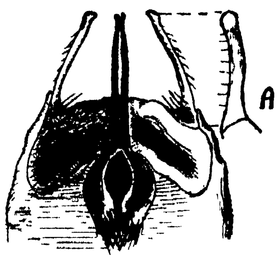
Testaceous, the upper half of the front, occiput, mesonotum except the broad sides, a large triangular spot on the sterno-pleura, most of the hypopleura, metanotum, and

abdominal markings black, cinereous pollinose. Length 6 mm.

Male.—Parafacials with a few short obscure hairs on the upper third; cheeks and posterior orbits with black hair; eyes almost touching for one-third the length of the front, the parafrontals very narrow; front widened above and below; only the two lower pairs of frontal bristles are strong, the remainder weak; ocellar bristles moderately strong; vertical bristles strong, reclinate; facial ridges with hairs on the lower half. Palpi yellow, with bristly black hairs. Antennæ reddish yellow; apical half of the arista

Fig. 3.

Fig. 4.



Tricyclea unipuncta, sp. n.

Fig. 3.—Costal region of wing.
Fig. 4.—Dorsal view of posterior and outer forceps of ♂. *A*, lateral view of arm of outer forceps.

and its rays black. The row of bristles along the side of the oral margin is fairly strong.

Mesonotum with four posterior dorso-central bristles; four pairs of marginal scutellars, the two intermediate pairs weak; a weak pair of apical bristles also present; two sterno-pleural bristles. Mesopleura, sterno-pleura above, and the upper part of the pteropleura black-haired, the pleura elsewhere with fine brassy-yellow hairs.

Posterior tibiæ and all the tarsi rather rusty reddish; hair and bristles wholly black; all the coxæ pale.

Wings lightly tinged with yellow, more so in front, with

a brown costal spot as shown in fig. 3; costal spine absent; third vein bristly almost to the small cross-vein. Lower squamal lobe yellowish; halteres yellow.

Second and third abdominal segments each with a broad blackish apical fascia which gradually narrows towards the sides and does not reach the ventral corners on the under side, the width at the middle equal to about one-third the length of the segment; fourth segment with the apical band broadly interrupted in the middle so as to form two transverse spots. Marginal bristles only long laterally, decreasing in length towards the middle of the dorsum and ventral portions of the tergites, not erect. The lobes of the fifth sternite are black, rounded apically, and bear short hair.

One male, Faradje, Belgian Congo, November 1912. Type in the American Museum of Natural History.

Tricyclea distigma, sp. n. (Figs. 5–7.)

Rusty yellow, the mesonotum black on the median three-fifths behind the suture and on the median one-third to half in front of the suture; mesonotum and abdominal fasciæ black. Length 6 to 7 mm.

Male.—Head whitish pollinose; occiput black on the upper two-thirds or less. Eyes separated by a distance equal to the width of the ocellar triangle; frontal vitta rusty reddish, sometimes as wide as a parafrontal opposite any given point; frontal bristles gradually decreasing in length upwards; upper part of the parafacials with a few yellow hairs; ocellar bristles fairly strong; verticals strong; facial ridges with bristly hairs on the lower half. Palpi with bristly black hairs. Arista with the apex and rays black.

Thorax cinereous pollinose; four pairs of posterior dorso-central bristles; two sterno-pleurals; hair of the pleura fine and yellow except on the upper part of the mesopleura and pteropleura, elsewhere on the thorax black. Hypopleura partly blackish.

Coxæ wholly yellow, the anterior pair with fine yellow hairs in addition to the black bristles. All the pulvilli small.

Wings greyish hyaline, with two brown spots as shown in fig. 5; third vein bristly between its base and the small cross-vein. Lower lobe of squamæ slightly tinged with brown. Halteres yellow.

The black apical fascia on the second abdominal segment is narrow, with a median, broad, triangular production, that

on the third segment tapering from the middle of the dorsum but not reaching the ventral corners of the tergite, its greatest width equal to between one-third and one-fourth the length of the segment (variable) ; the fourth segment bears a broadly interrupted apical fascia which forms an elongate-oval spot on either side. The fifth

Fig. 5.

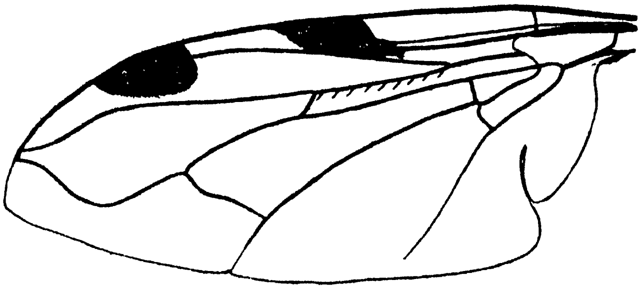
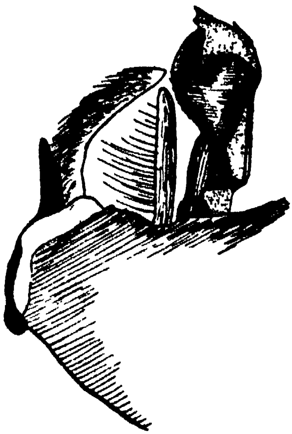


Fig. 7.

Fig. 6.



Tricyclea distigma, sp. n.

Fig. 5.—Wing.
Fig. 6.—Dorsal view of posterior and outer forceps of ♂.
Fig. 7.—Lateral view of ♂ genitalia.

sternite is large, blackish, divided by a broad median excision into two lobes which are gently concave and have raised margins, the inner margins with several bristly, the outer with rather abundant, short black hairs, the inner apex of each lobe subtriangularly produced.

Holotype, male, Boma, Belgian Congo, 16th June, 1915; paratype, male, Faradje, Congo, November 1912.

This may eventually prove to be the male of *perpendicularis*, Villen., but, until a series of specimens connecting the typical examples is available, it seems advisable to regard the two as distinct.

Tricyclea nigroseta, sp. n.

Rusty yellowish, the occiput black on the upper half or more, except a median vitta; mesonotum with two broad black vittæ, tapering and abbreviated posteriorly; metanotum, part of the hypopleura, and the abdominal fasciæ black. Length 6·5 mm.

Female.—Front half as wide as one eye, scarcely narrowed anteriorly, the frontal vitta three times as wide as a parafrontal, widest above, gradually narrowing anteriorly; all the frontal bristles of almost equal strength; no orbital bristles; ocellar and post-ocellar bristles fairly strong; outer vertical bristles somewhat weaker than the verticals. Parafacials with an orbital row of short black hairs and a second row continued from the frontals reaching to below the middle of the face. Occiput with yellow hairs except towards the orbits, the cheeks with only a few of the posterior hairs pale. Palpi with black bristles. Facial ridges with bristly hairs on the lower half. Arista black with the basal segment red, the rays black.

The black mesonotal vittæ cover the anterior two-thirds and are separated from each other by the pale space between the acrostichal rows, extending to outside the dorso-central rows anteriorly and more or less distinctly continued backwards from their outer posterior end as a narrow line. Four pairs of postero-dorsal bristles; two sterno-pleurals. Hair of the pleura fine and brassy yellow, except on the upper parts of the mesopleura and pteropleura.

Anterior coxæ with fine yellow hair basally; posterior femora and tibiæ tinged with brownish in front.

Wings cinereous hyaline, the stigmal spot large, not extending to the second vein, the marginal cell brown for two-thirds the distance from the second to the first vein, the brown colour reaching halfway across the submarginal cell. Third vein with strong bristles between the base and the small cross-vein. No costal spine.

The dark fascia on the second abdominal segment occupies a little more than the posterior fourth of the segment, is triangularly produced to the basal third in the middle, and

narrowed on the under side. The band in the third segment occupies the posterior half of the segment, is rectangularly produced to the base in the middle, and strongly narrowed on the under side. The broadly interrupted apical fascia on the fourth segment extends slightly on to the under side.

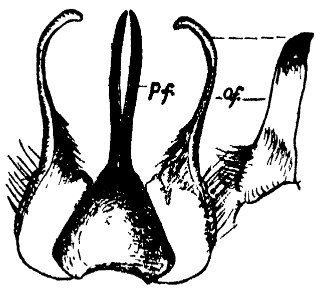
A single female, Medje, Belgian Congo, Sept. 1910. The type is in the American Museum of Natural History, New York.

Tricyclea bivittata, sp. n. (Figs. 8 & 9.)

Rusty reddish yellow, the ocellar triangle, occiput except below, two broad mesonotal vittæ, metanotum, spot on the hypopleura, and the abdominal fasciæ brownish black; wings largely brown anteriorly. Length 7 to 8 mm.

Fig. 8.

Fig. 9.



Tricyclea bivittata, sp. n.

Fig. 8.—Costal region of wing.
Fig. 9.—Dorsal view of posterior and outer forceps of ♂. *p.f.*, posterior forceps; *o.f.*, outer forceps.

Male.—Six or seven rather weak frontal bristles in each row; a row of tiny orbital hairs extends on to the face as far as the base of the arista; eyes almost touching for one-fifth the length of the front. Ocellar bristles fairly strong, post-ocellars weak; verticals strong, but little convergent. Occiput rather dull black above, the orbits grey pollinose; cheeks wholly clothed with black hairs; a strong bristle at the oral angle, the oral vibrissæ still stronger, the others

weak, the facial ridges with short hairs on more than the lower half. Third antennal segment orange; arista brownish yellow, brown apically, the moderately long rays black. Palpi yellow; proboscis black, with yellow labella.

The black mesonotal vittæ vary somewhat in width, usually occupying the space between the acrostichals and intra-alars, tapering posteriorly, and not nearly reaching the scutellum. Thorax thickly cinereous pollinose. Four pairs of posterior dorso-central bristles, two sterno-pleurals. Pile of the mesopleura and sterno-pleura mostly black; also some black hairs on the pteropleura.

Legs reddish yellow; posterior femora with small apical spot above, their tibiæ darkened apically, all the tarsi becoming brownish towards their apices. The dense yellow setulæ on the ventral surface of the posterior tarsi extend only to the apex of the second segment.

Wings cinereous hyaline, broadly brown in front as indicated in fig. 8.

The first abdominal segment bears a linear posterior brown stripe on either side; dark fascia on the second segment moderately narrow, a little broadened in the middle; on the third segment the fascia occupies the posterior third to one-half in the middle, is slightly narrowed laterally, and strongly narrowed on the under surface; fourth segment with a pair of apical, moderately separated, elongate-oval spots, which do not extend over the sides. Lobes of the fifth sternite yellowish, emarginate on the inner end, rather obtuse apically.

Female.—Front less than half as wide as one eye, noticeably widened above, ferruginous or brownish on the upper half or third, the frontal vitta reddish; parafrontals one-fifth as wide as the frontal vitta, pale yellowish pollinose on the lower half; outer vertical bristles three-fourths as strong as the verticals; ten to twelve frontals in each row and two pairs of divergent or reclinate ones above. The black abdominal fasciæ are broader, that on the first segment almost entire, the second occupying more than the posterior third of the segment, the third more than half and almost reaching the base in the middle.

Described from the following specimens: three males, two females, Prospect, 18th and 19th March, 1923; male, East London, 9th June, 1923; all collected by Mr. H. K. Munro.

TRICYCLODES, gen. nov.

Differs from *Tricyclea* by the absence of any hairs on the median portion of the propleura, in front of and below the prothoracic stigma.

Genotype, *T. pallens*, sp. n.

Tricyclodes pallens, sp. n. (Fig. 10.)

Wings wholly cinereous hyaline; pale rusty yellow, a small spot on the mesopleura above, the metanotum except a broad median vitta, and fasciæ on the second and third abdominal segments brownish; mesonotum rusty reddish, with two or four blackish vittæ on the anterior two-thirds, which do not extend over the anterior margin, the broader ones lying between the acrostichal and dorso-central bristles, the narrow ones just outside the dorso-centrals. Length 6 to 7 mm.

Fig. 10.

Tricyclodes pallens, sp. n.

Lateral view of posterior and outer forceps of ♂.

Male.—Eyes narrowly separated by the linear yellowish pollinose parafrontals; six pairs of weak frontal bristles, the lower two or three somewhat strengthened; ocellar bristles at most weakly differentiated from the longish hairs; vertical bristles rather short. Upper half of the occiput black except for a median vitta; cheeks wholly black-haired; the bristles along the oral margin conspicuous; facial ridges with weak bristles on not more than the lower half. Palpi and proboscis reddish, with black hairs and bristles. Third antennal segment orange, the arista yellow on the basal fifth, the black rays not numerous. Ocellar triangle brownish.

Hairs on the mesopleura and pteropleura black, elsewhere on the pleura yellow. Four pairs of posterior dorso-central bristles, two sterno-pleurals. Thorax thickly cinereous pollinose.

Legs reddish; the squamose yellow setulæ extend to the apex of the third segment of the posterior tarsi.

The fasciæ on the second and third abdominal segments are rather poorly defined, about one-third as wide as the length of the segment, triangularly produced forwards in the middle. Fourth segment densely cinereous pollinose. Lobes of the fifth sternite rather rounded apically, pale in colour. Outer genital forceps long and moderately narrow (fig. 10).

Described from the following specimens: Type, male, Pretoria, South Africa, 1st August, 1913; male, Pretoria, 22nd January, 1912; male, Prospect, 19th March, 1923; male, East London, 9th June, 1923; male, Pretoria, 23rd February, 1915; male, Barberton, 9th May, 1914; all collected by Mr. Munro; and a male from Que Que, S. Africa, 17th April, 1921 (*J. D. W.*).

Tricyclodes difficilis, sp. n. (Fig. 11.)

Agrees with *pallens*, except as follows: The ocellar bristles are normally well developed and stand out conspicuously; the scutellum is not at all darkened above;

Fig. 11.

Tricyclodes difficilis, sp. n.
Lateral view of arm of outer forceps of ♂ genitalia.

the mesonotum is usually all shining rusty reddish, rarely with a pair of widely separated, obscure, brownish vittæ, and the outer genital forceps are very much broader and shorter. Notwithstanding these differences, the dark specimens of *difficilis* are hard to separate without examination of the genitalia.

Female.—Structure as in other described species of the sex. Ocellar bristles strong; thorax wholly reddish yellow.

Described from the following specimens from South Africa: Type male, New Hanover, Natal, 14th December, 1913, collected by Mr. C. B. Hardenberg; female, Barberton, 1st May, 1913, male, Barberton, 21st May, 1915, both collected by Mr. H. K. Munro; and a male, Que Que, 17th April, 1921 (*J. D. W.*).

LV.—*New Species of Calyptrate* Muscidæ *from Africa (Diptera).* By C. H. Curran, Entomological Branch, Ottawa, Canada.

I present here descriptions of five species of Diptera belonging to the families Sarcophagidæ, Calliphoridæ, and Muscidæ, the specimens forming the basis of the descriptions having been received from Mr. H. K. Munro, Pretoria, South Africa, and Dr. Guy A. K. Marshall, Imperial Bureau of Entomology. Representatives of all but one of the species will be deposited in the British Museum of Natural History.

Sarcophagidæ.

Angiometopia munroi, sp. n.

Black; cinereous pollinose; mesonotum with three black vittæ; second to fifth abdominal segments each with five shining black dorsal spots. Length 14 to 16 mm.

Male.—Front four-sevenths as wide as either eye, the narrow silvery parafrontals less than one-third as wide as the opaque black frontal vitta; two pairs of frontal bristles below the base of the antennæ, the upper frontal reclinate; ocellars weak; outer verticals half as long as the verticals; two or three irregular rows of black hairs behind the occipital cilia; cheeks with coarse black hair except posteriorly; occipital pure white; parafacials with some coarse black hairs. Head silvery. Cheeks almost half as wide as eye-height. Palpi and antennæ black, the third antennal segment over twice as long as wide; arista short plumose on the basal half. Median black vitta on the mesonotum narrow, widened behind, extending over the scutellum; outer vittæ rather narrow, entire, reaching to the base of the scutellum. A weak pair of prescutellar acrostichals; two pairs of posterior dorso-centrals, the anterior pair weak, and there may also be an extremely weak presutural pair; one intra-alar; presutural bristle strong; three sternopleurals, the middle one weak; two pairs of marginal scutellars and a very weak cruciate apical pair, the scutellum without discals. Legs black, the anterior femora grey pollinose behind, the others thinly so beneath; all the femora with long pile beneath, the posterior four tibiæ strongly villous on both sides, the anterior pair with long hair on the posterior apical half; pulvilli large, reddish; posterior femora arcuate, not unusually large, their tibiæ curved apically. Wings cinereous yellow, broadly orange basally

and almost to the middle in front; third vein bristled almost halfway to the small cross-vein. Squamæ orange, the apical half of the lower lobe usually mostly whitish. Halteres yellow. Abdomen cinereous pollinose, the first segment thinly so dorsally, with three large shining black spots; each of the following segments bears five shining black spots above, a rather small one on either side in front and a small one on either side behind, those on the second segment rather obscure, and a large median spot, that on the second segment suboval, reaching from the apex to the base, that on the third segment triangular, narrow, not quite reaching the base, that on the fourth segment transverse, limited to the apical fourth or fifth; in addition, the second to fourth segments bear each a small round black spot beneath the lateral margins, a little in front of the middle. First genital segment shining black, without bristles, the second bright reddish.

Female.—Front as wide as either eye, with two pairs of orbital bristles; no apical scutellars, but a pair of small, widely separated preapicals; spots on the abdomen all of nearly the same size, except the median ones, the abdomen inclined to be somewhat tessellate. Genitalia reddish, split above. Legs simple.

Type, male, allotype, female, and two paratype males and one female, Uitenhage, South Africa, 15. iii. 1919 (*H. K. Munro*).

The following table will separate the African species, in so far as they are sufficiently described to be incorporated in a key:—

Key to Species of Angiometopia, *B. B.*

1.	Legs black	2.
	Femora reddish, with black apices	*dimidiatipes*, Villen.
2.	Wings with brown spots	3.
	Wings cinereous hyaline, the base broadly orange	*munroi*, Curran.
3.	Wings with one strong brown spot	*monospila*, Bezzi.
	Wings with three or four brown spots	4.
4.	Wings with three brown spots	*spilogaster*, Wied.
	Wings with four brown spots	*octomaculata*, Jaenn.

Calliphoridæ.

Stomorhina fasciculata, sp. n.

Superficially similar to *S. lunata*, Fabricius, but slightly smaller and with brownish-tinged wings; its colour is almost identical with that of the form of *lunata* described as *Idia*

rostrata by Wiedemann. However, there are abundant differences between the males: *S. fasciculata* bears a conspicuous tubercle near the basal third of the anterior coxæ towards the inner side, and this is armed with about ten short stout bristles, while the lower surface of the abdomen is largely clothed with orange-coloured hair, which is dense and crinkly on the sternites and forms a sharp contrast to the rather sparse, erect, yellowish pile found in *lunata*. Length 6 to 7 mm.

Male. Head black, the occiput and posterior half of the cheeks (the limits oblique) grey pollinose and pale greyish pilose, the hairs on the cheeks each arising from a very small dark puncture; hair on the black part of the cheeks obscure; "soft" parts of the face black; parafacials with just a trace of pollen on the lower end, their upper half and the parafrontals greyish yellow pollinose, the frontal hairs and bristles confused, so that the frontals appear numerous and fine, and each arises from a small black puncture. Frontal vitta triangular above and below, the eyes separated on a wide space near the upper third by only the linear black parafrontals. Ocellar bristles but little stronger than the long black hairs; verticals fairly strong. Palpi broad, opaque blackish. Antennæ black; third segment brownish, its apex oblique below, obtusely pointed above; arista reddish basally, with about a dozen rays above on the subbasal half. Mesonotum æneous, greyish pollinose, each hair arising from an opaque black dot, the three opaque black vittæ wide, very conspicuous from posterior view, the scutellum only weakly spotted with black. Pleura thickly pollinose, grey behind, greyish yellow in front and golden yellow above, almost bare on the large median area. Bristles of the mesonotum greatly reduced, a single fine acrostichal and dorso-central in front of the scutellum; only the posterior intra-alar, two bristles on the posterior calli; two supra-alar, one presutural, two notopleural, and one humeral; two sterno-pleurals and three pairs of marginal scutellars. The hair of the mesonotum and scutellum is fairly abundant, moderately long, and suberect; the ventral scutellar fringe is pale, not dense. Mesopleura and pteropleura with black hair, the pleura elsewhere with pale yellow pile. Pectus with abundant orange pile in the middle. Coxæ with abundant orange pile, except on the basal half or more of the anterior pair, where it is sparse. Legs black; middle and posterior tibiæ and the first segment of their tarsi brownish red; hair black. Wings more or less brownish-tinged, brown basally. Squamæ yellowish brown or brownish

yellow, paler basally. Halteres yellow. Abdomen shining black, the second and third segments orange, except a broad median vitta and narrow apices, the inner end of the orange spots rounded in front on the second segment and behind on the third, the first segment often with a reddish subapical streak on either side, its lower surface broadly yellow towards the middle of the abdomen; sternites yellow; fourth segment with a pair of large, transverse, slightly oblique, elongate-oval, grey pollinose spots. Hair of the abdomen black, short, abundant dorsally; no dorsal bristles except on the apex of the fourth segment; sides of the first segment with rather numerous black bristly hairs on the apical half, of the second with three or four apical bristly hairs, the third with three long fine bristles; fourth with long bristly hairs on the sides below.

Type, male and three male paratypes, Willow Grange, Natal, 3. v. 1914 (*R. C. Wroughton*), and one male, Pretoria, 10. i. 1915 (*H. K. Munro*). Type in the British Museum.

I have not been able to find any females of this species. *S. lunata* is not rare in South Africa. Mr. Munro has taken it in various localities and Mr. Wroughton has several specimens from Willow Grange and Estcourt, Natal.

Muscidæ.

Pyrellia mitis, sp. n.

A very small green species, the males usually brassy or somewhat bronzed; anterior thoracic spiracle white.

Length 4 to 5 mm.

Male.—Head black in ground-colour, the face and the lower fourth of the front silvery-white pollinose; frontal vitta linear, except near the ocelli; frontal and ocellar bristles weak; verticals strong; hairs of the occiput and cheeks brownish. Palpi black. Antennæ brown; rays of the arista very long. In some views the lower part of the occiput appears thinly brownish-yellow pollinose. Thorax very thinly tawny pollinose; only one pair of acrostichals, the prescutellars; dorso-centrals 2–4, the anterior two pairs of post-suturals very weak, sometimes scarcely evident; a strong pre-alar; sterno-pleurals 1–2 or 3; two pairs of marginal scutellars, the apical pair well separated from each other, and a pair of weak discals; several fine, obscure, longish hairs below the posterior spiracle. Legs black. Wings hyaline, the veins yellow basally. Squamæ lightly infuscated, the base and upper lobe white. Halteres yellow. Third and fourth abdominal segments each with a row of

fine marginals, the fourth segment with long, erect, sparse hair, the hair elsewhere on the dorsum short and appressed, long and brownish ventrally.

Female.—Front shining black laterally, more or less green above, pollinose on the lowest third; frontal vitta brown, wide; one strong orbital and a weak one above; outer verticals absent.

Type male, allotype female, Barberton, South Africa, 15. v. 1913; paratypes, six males, four females, Barberton, 2, 5, 6, and 15. v. 1913 (*H. K. Munro*).

In Malloch's key (Ann. & Mag. Nat. Hist. (9) xii. pp. 515–519, 1923), this species runs down to *Orthelia spinthera*, Bigot, which has brown anterior spiracles on the thorax.

Anthomyia sensua, sp. n.

Close to *benguellæ*, Malloch, but the presutural black spots extend broadly over the anterior slopes of the mesonotum in most views and the outer border of the lobes of the fifth sternite is broadly rectangularly produced; in this respect more closely resembling *indica*, Malloch. Cinereous pollinose, with opaque black markings.

Length 5 to 5·5 mm.

Male.—A blackish spot opposite the antennæ and behind the vibrissal angles; frontal vitta black, obsolete for almost half its length, the orbits narrow; three pairs of frontal bristles, the intra-frontals distinct. Hair black. Palpi and antennæ black; aristal pubescence shorter than the width of the arista. Mesonotum with two large, roundish, presutural, opaque black spots which, in most views, are extended over the anterior slopes, and with a broad postsutural black fascia which is bi-emarginate in front and quadri-emarginate behind. Scutellum black, except the small apex; pleura bordered above, in front of mesopleura, with a broad blackish vitta. Dorso-centrals 2–3; sterno-pleurals varying from two to four, the lower two weak. Legs black, the femora more or less brownish; posterior tibiæ with two postero-dorsal bristles, a row of six or seven antero-dorsal, and a partial row of five to seven short fine posterior bristles near the lower edge. Wings with cinereous tinge; costal spine absent; third vein curved conspicuously backwards before its tip. Squamæ white; halteres pale yellow. Second to fourth abdominal segments each with the base broadly black, produced in the middle to form a broad vitta, tapering on each segment and

not reaching the apex of the fourth, and also roundly produced backwards towards either side. Genitalia polished black, the first segment, when visible, reddish; fifth sternite carried longitudinally downwards.

Type, male, New Hanover, Natal, viii. 1914 (*C. B. Hardenberg*); allotype, female, New Hanover, 1. xii. 1914 (*Hardenberg*); paratypes, 2 ♀♀, New Hanover, 1. xii. 1914; ♀, Bloemfontein, v. 1920 (*H. E. Irving*); 4 ♂ ♀, Pretoria, 10, 17. i. 1915, 3, 4. x. 1920 (*H. K. Munro*); ♂, Umvuma, Rhodesia, 21. xii. 1917 (*A. T. J. Janse*).

Types in Mr. Munro's collection; paratypes in the British Museum.

Anaphalantus maculitarsis, sp. n.

Differs from *A. pennatus*, Loew, in lacking squamose hairs on the front tibiæ, the row of hairs being long and fine on the apical two-thirds of the anterior tibiæ, the front tarsi very long, brownish above, the base reddish, the fourth segment yellow, the fifth broadened, the basal four segments whitish except above.

Length 4·75 mm.

Male. Front at the vertex about four-sevenths as wide as either eye, somewhat narrowed anteriorly; with four pairs of strong, and three weak, frontals, the upper three strong pairs more or less reclinate; ocellars long; outer verticals distinct; parafrontals almost linear, greyish pollinose; frontal vitta black, with a slender, not conspicuous, median triangle, reaching almost to the lunule. Lower mouth-edge strongly convex on the anterior half; face gently concave in profile, the oral margin as prominent as the antennal base; vibrissæ situated slightly above the oral margin; parafacials with almost parallel sides, the facial depression deep. Palpi brownish. Antennæ black, the third segment almost three times as long as wide; arista short plumose on its whole length. Thorax cinereous pollinose, the mesonotum behind the suture, except for a narrow pre-scutellar fascia, and two large spots inside the humeri, brownish pollinose, rather shining. Scutellum brown pollinose, the disc largely grey. No acrostichals; dorso-centrals 2–3; pre-alars absent; sternopleurals 1–1; two pairs of strong scutellars, the apical pair approximate. Legs black; tibiæ brownish red; front femora with a row of long coarse hair above and below on the posterior surface; middle femora without bristles; posterior femora with two long antero-ventral bristles near the apical fourth; middle tibiæ with two weak antero-dorsal bristles, the posterior tibiæ with one near the middle. Wings cinereous

hyaline; fourth vein slightly curved forwards before its tip; third vein with a single basal above, two below. Squamæ large, whitish; halteres reddish yellow. Abdomen grey pollinose, with large brown triangles, those on the fourth segment united, the others reaching the base and lateral margins, the first segment almost wholly brown. Hair of the whole insect black.

A single male, Barberton (Stentor Farm), 24. viii. 1924 (*H. K. Munro*).

LVI.—*South Indian Arachnology.*—Part II. By W. RAE SHERRIFFS, M.A., D.Sc., F.L.S., formerly Professor of Zoology, University of Madras, Professor of Zoology, University College, Southampton.

SOME time ago I published in this Magazine * a preliminary account of the spider-life of South India and Ceylon, including specimens from both the hills and the plains, noting carefully the localities at or from which I obtained them. The present paper is a continuation of the same subject, dealing with forms that have since come to hand, in particular the results of a collection made in Coorg during two brief holidays spent there. Localities now mentioned for spiders reported in the previous paper are new ones in addition to those already given.

My best thanks are due to A. S. Hirst, F.L.S., of the Arachnid Department, British Museum (Natural History), South Kensington, and to MM. Fage and Berland, of the Muséum National d'Histoire Naturelle, Paris, for the kindness with which they have granted me every facility at their disposal for the examination and identification of my specimens.

Uloboridæ.

ULOBORUS (Latr.), 1806.

1. *Uloborus geniculatus* (Oliv.) = *U. zosis* (Walck.).

Described by Walckenaer, Hist. Nat. d. Ins., Apt. ii. p. 231 (1841).

The specimen from Mangalore had its web placed almost vertically against the garden wall. The stabilimentum formed a large circular white mass upon which the spider

* Ann. & Mag. Nat. Hist. ser. 9, vol. iv., Oct. 1919, pp. 220–253.

rested at the centre of the orb-web, with a band as an incomplete radius proceeding vertically downwards in line with the long axis of the spider's body.

This account agrees completely with the description given by Comstock in his 'Spider Book,' p. 269, where also are figured the spider (p. 268) and the cocoon (p. 269).

Locality. "Charlotte Estate," Sidapur, South Coorg (December and January), at 3000 feet above sea-level; Mangalore (December); Madras Christian College, Madras City (March); on all of which occasions no cocoons were found.

2. *Uloborus bigibbosus* (Sim.).

Described by Simon, 'Arachnides de l'Inde,' p. 163 (1905). These were found only once, associating together in considerable numbers. The cocoons are light brown in colour and similar in size and shape to those of *U. geniculatus*, but with fewer lobes.

Simon states that this species, which very closely resembles *U. pinnipes* (Thor.), is widespread in India and Ceylon.

Locality. High Court Compound, Madras City (March).

The following species of this genus, alphabetically arranged, have been described from Burma, Ceylon, and India:—

1.	*Uloborus bigibbosus* (Sim.), 1905.	Ceylon and India.
2.	—— *geniculatus* (Oliv.), 1789.	Burma, Ceylon, and India.
3.	—— *leucosagma* (Thor.), 1895.	Burma.
4.	—— *limbatus* (Thor.), 1895.	"
5.	—— (*Philoponus*) *lugubris* (Thor.), 1895.	"
6.	—— *manicatus* (Thor.), 1895.	"
7.	—— *mollis* (Thor.), 1895.	"
8.	—— *nasutus* (Thor.), 1895.	"
9.	—— *omœdus* (Thor.), 1895.	"
10.	—— (*Philoponus*) *pteropus* (Thor.), 1887.	"
11.	—— *truncatus* (Thor.), 1895.	"
12.	—— *umboniger* (Kulcz.), 1908.	Ceylon.

Simon's specimen of *U. bigibbosus* came from Pondicherry, S. India, and is described, as stated above, in his 'Arachnides de l'Inde,' the full title of which is the 'Voyage de M. Maindron dans l'Inde Méridionale,' published by the Société Entomologique de France, vol. lxxiv. (1905).

Dictynidæ.

DICTYNA (Sund.), 1833.

In his 'Histoire Naturelle des Araignées,' vol. i. p. 235,

Simon notes that this family has throughout the world representatives which are, however, much more abundant in the temperate regions than in the tropics, where they are found generally in the high mountains. In agreement with this statement, the only Dictynid I have got is one species from the Nilgiris.

The members of this genus are known to live on plants, and these Ootacamund spiders are lovely little brown and green ones, both sexes being found on the same leaf of the bush sheltering under the irregularly spun web. Sometimes, however, the female is got alone under the web, which stretches like a sheet across the curled leaf.

Simon, in his 'Arachnida of the Maindron Journey in South India,' pp. 164–7, describes fully the three species obtained by M. Maindron, viz., *turbida* (Sim.) from the Nilgiris, and previously got at Kodaikanal on the Palnis by Simon himself, and *nigricauda* (Sim.) and *smaragdula* (Sim.) from Ceylon, both of these being new species, of which the last is an emerald-green one, as the name signifies, approaching closely in colour the European *D. viridissima* (Walck.), where, among other characteristics, the cephalothorax is bordered by a white band either complete or broken up.

My specimens on examination prove to be quite distinct from the three above mentioned. When alive the colour-scheme was as follows :— ♀. Cephalothorax, sternum, coxæ, and femurs of the last pair of legs drab-yellow ; rest of the legs grass-green ; abdomen prettily marked dorsally in shades of green on a creamy ground, with two yellow-green lines down each side, and between these lines chevron bands of light and dark green alternately ; ventrally the abdomen between vulva and the spinnerets bluish grey, spinnerets light green.

♂. Similar to the female, but with cephalothorax dorsally deep red-brown and the other parts similar but a much darker shade.

The following species of *Dictyna* are reported from India and Ceylon :—

1. *Dictyna bispinosa* (Sim.).	Burma.
2. —— *grossa* (Sim.).	Himalayas.
3. —— *kandiana* (Sim.).	Ceylon, Kandy.
4. —— *nigricauda* (Sim.), 1905.	" "
5. —— *smaragdula* (Sim.), 1905.	" "
6. —— *turbida* (Sim.), 1905.	Trichinopoly, mountains of S. India.
7. —— *velifera* (Sim.).	Sikhim.

To this number it seems advisable to add one more.

The collection of spiders sent home by Cecil Oates to the British Museum, and worked out by Prof. Thorell in 'The Spiders of Burma,' 1895, evidently contained no member of this genus, because the area searched was Lower Burma mainly round Rangoon and Tharawaddy.

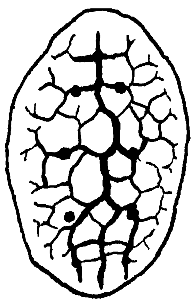
3. *Dictyna marakata*, sp. n.

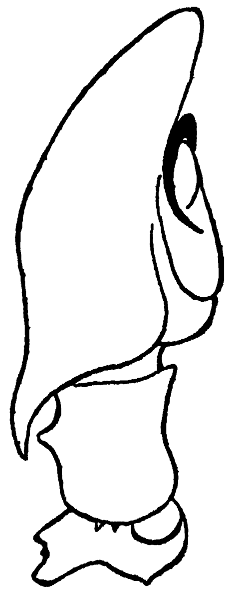
♀ (in spirit) 5 mm. long.

Cephalothorax. Cephalic part red-brown bordered in front of eyes in dark brown; thoracic part red-brown, but pale at margins and above the central fovea, from which dark brown

Fig. 2.

Fig. 1.





Dictyna marakata, sp. n.

Fig. 1.—Female; dorsal aspect of abdomen. × 12.
Fig. 2.—Male; outline of palp. × 60.

striations on a green ground radiate to meet in an interrupted dark brown band within the pale marginal area.

Eyes. Front row distinctly recurved, back row equidistant, almost straight, laterals closer together than medians, the area of which forms almost a square; anterior medians smaller and darker, brown lines in front of and also between the medians.

Clypeus. Red-brown, narrow, much less than length of cheliceræ.

Abdomen. Oval, dorsally covered with short white hairs, marbled with light and dark green veins on a cream ground, the dark green marks forming a median irregular meshwork (see fig. 1) connecting with four pairs of small dark green depressions, the front two pairs of which are most distinct and deeper than the others; colour-scheme, median area light green bordered by broken cream lines meeting at front end, then outside these lines dark green towards the sides; ventrally mottled light and dark green; epigyne pale, glabrous, spinnerets greenish yellow.

Sternum. Fawn, lighter towards centre, sparsely covered with short curved hairs.

Cheliceræ. Red-brown, base of each unguis a light round spot.

Legs. Fawn, 1, 2, 4, 3.

♂. 4 mm. long, with the same livery as the female and practically identical markings. The palp has the patella armed to the outside with a large bidentate process, and below with a much smaller single one at the base; the tibia is much larger and bears to the outside a single blunt point opposite the large external posterior process of the tarsus, while internally at the opposite top corner a blunt point occurs; the tarsus is longer than patella and tibia combined, bears the large hooked process above mentioned, and narrows from the base upwards (see fig. 2); the whole armed with dense white hairs.

The arrangement comes close to that in *D. smaragdula* (Sim.) as given in 'Arachnides de l'Inde,' fig. 2, p. 166, in its general plan, but differs in the structure of the tibia and patella sufficiently to render the two at once distinct.

The above descriptions are from spirit-specimens which have retained their vivid colours even after eight years' immersion. Because of their beautiful green coloration I have chosen the specific name from the Sanskrit "marakata," meaning emerald. In all nine females and four males were examined.

Locality. Ootacamund, Nilgiris, at 7200 feet (September).

Eresidæ.

Stegodyphus (Sim.), 1873.

4. *Stegodyphus sarasinorum* (Karsch).

Described by Karsch, Berl. ent. Zeitschr. xxxvi. p. 275 (1892).

Locality. Mysore City (December), 2450 feet.

Hersiliidæ.

HERSILIA (Sav.), 1827.

5. *Hersilia savignyi* (Luc.).

Described by Lucas, Mag. de Zool. vi. année, classe viii. p. 10 (1836).

Locality. Mercara, Coorg (December), at 3700 feet; Sidapur, South Coorg (April). No cocoons got.

Pholcidæ.

ARTEMA (Walck.), 1837.

6. *Artema atlanta* (Walck.).

Described by Walckenaer, Ins. Apt. i. p. 656 (1837).
Locality. Mangalore.

SMERINGOPUS (Sim.), 1890.

7. *Smeringopus elongatus* (Vin.).

Described by Vinson, Aran. d'Isles Réunion &c. p. 135 (1863).
Locality. Mangalore; Sidapur, S. Coorg.

Theridiidæ.

ARGYRODES (Sim.), 1864.

8. *Argyrodes epeiræ* (Sim.) = *Argyrodes gibbosus* (H. Lucas).

A single female taken from its small web on a leaf of bush.

Locality. Madras City, on the beach.

This species is quoted by O. P. Cambridge (Journ. Linn. Soc., Zool. vol. x. 1869, p. 382) as being European and Syrian, while Simon ('Arachnides de France,' tome vi. 1914, p. 290) gives its distribution as the whole of the southern Mediterranean region and a great part of Africa and of Asia. Thorell ('Spiders of Burma,' p. 117) records finding very dark individuals of *A. flavescens* (Camb.), and it is possible that the present example may be one such.

The following species of this genus are recorded from our area:—

1.	*Argyrodes apiculatus* (Thor.), 1895.	Burma.
2.	—— *argentatus* (Camb.), 1880.	Burma, Ceylon, and India.
3.	—— *callipygas* (Thor.), 1895.	Burma.

4. *Argyrodes fissifrons* (Camb.), 1869. — Burma, Ceylon, and India.
5. —— *flavescens* (Camb.), 1880. — Burma, Ceylon.
6. —— *miniatus* (Dol.). — Ceylon.
7. —— *nasutus* (Camb.), 1880. — Ceylon (Kandy).
8. —— *procrastinans* (Camb.), 1880. — India (Bombay).
9. —— *scintillulana* (Camb.), 1880. — Ceylon.
10. —— *xiphias* (Thor.), 1887. — Burma.

The Rev. O. P. Cambridge, in his valuable paper on this genus (Proc. Zool. Soc. 1880, pt. ii. pp. 320–344), describes over twenty species, noting *A. epeiræ* (Sim.) as the type, with a distribution throughout South Europe and Madagascar, Asia, and Africa. Careful figures of the male palps of each species would have been a most valuable addition to the excellent illustrative plates provided.

MEOTIPA (Sim.), 1893 = PHYSCOA (Thor.), 1895.

9. *Meotipa picturata* (Sim.).

A peculiarly spiky spider with a tuft at tip of abdomen. It agrees excellently with Simon's figures for *M. vesiculosa* (Sim.) in his Hist. Nat. des Araignés, p. 514, vol. i. figs. 522 & 527, which show the knobbed character of the abdomen and the characteristic short lanceolate black hairs, which in this case are found not only on the abdomen but also at the joints of the legs, and not restricted solely to the tips of the front tibiæ, as in fig. 527 given for *M. vesiculosa.* From the description on p. 516 Simon mentions that the other species (*M. picturata?*) has the abdomen and limb-joints furnished as well. Hence I take it that fig. 522, though stated to be that of *M. vesiculosa*, is really that of *M. picturata.*

The spider was taken from the centre of an orb-web.

Thorell's *Physcoa scintillans* ('Spiders of Burma,' p. 83) has the abdomen black and silvery, and there are none of these characteristic black hairs either on abdomen or legs. *P. scintillans* (Thor.) greatly resembles the closely allied *Thwaitesia margaritifera* (O. P. Camb.), which has the abdomen covered with pearly silvery spots.

Locality. Charlotte Estate, Sidapur, S. Coorg, at 3000 feet (December).

M. vesiculosa (Sim.), 1894, is reported from the Philippines and *M. picturata* (Sim.) from South India; *M.* (*Physcoa*) *scintillans* (Thor.), 1895, from Burma.

THERIDION (Walck.), 1805.

10. *Theridion mundulum* (L. Koch) = *T. amœnum* (Thor.).

Described by L. Koch, Die Arach. Australiens, vol. i.

15.	*Theridion oatesii* (Thor.), 1895.	Burma.
16.	—— *oleatum* (Thor.).	"
17.	—— *quadripapulatum* (Thor.), 1895.	"
18.	—— *rufipes* (Luc.).	Burma, Ceylon.
19.	—— *saropus* (Thor.).	Burma.
20.	—— *T-notatum* (L. Koch), 1895.	"
21.	—— *tepidariorum* (C. L. Koch), 1841.	World-wide in tropics.
22.	—— *thalia* (Work.).	Burma.
23.	—— *workmanii* (Thor.), 1887.	"

LVII.—*A new Species of the Genus* Sicista. By J. L. Chaworth-Musters.

The occurrence of a species of the genus *Sicista* in Norway has been known since 1906, when Dr. Collett, of Oslo (Kristiania) University, received specimens from a collector at Opdal on the Dovrefjeld. Dr. Collett, in his book 'Norges Pattedyr,' described these and other specimens from Central Norway under the name *Sicista subtilis*, Pallas. In the summer of 1926 the author was fortunate enough to obtain three specimens of this *Sicista* in the hills above the Surendal in Nordmore, and on comparing these with specimens of *Sicista trizona* (=*S. subtilis*) from Central Europe and Asia, they were found to be so different as to be considered a distinct species. It may be described as

Sicista norvegica, sp. n.

Sicista subtilis, Collett, Norges Pattedyr. p. 68 (1912).

Type.—B.M. no. 26. 11. 21. 17. Adult male. Collected September 1st, 1926.

Type-locality.—Volde, Surendal, Nordmore, Norway.

Range.—Probably the mountainous regions of Central Scandinavia from Valdres in Norway to North Jamtland in Sweden.

Characters.—Size and general external appearance as in *S. trizona.* Hind foot 17 mm. Condylo-incisive length of skull 16·6 mm., or perhaps more in old individuals. Colour of sides and back yellower and not so rufous as in *S. trizona.* The underfur is between the deep olive-buff and the cinnamon-buff of Ridgway. The dorsal stripe is very conspicuous—starting between the eyes, it forms a large black patch about 6 mm. broad on the crown, and extends backwards to the base of the tail. Underpart dull ochraceous buff. There is a conspicuous dark greyish-black patch on the nose. Ears dark blackish buff, with a sharply defined light buff rim. Tail distinctly bicolour, blackish grey above, light grey below.

The skull and teeth are essentially as in *S. trizona*, but the skull differs from it (in the scanty material examined) by the more inflated brain-case, broader interorbital region, less spreading zygomatic arches, larger bullæ, and shorter palatal foramina.

Measurements of type (taken in the flesh).—Head and body 67 mm.; tail 90; hind foot 17; ear 10.

Cranial measurements of type.—Condylo-incisive length 16·6 mm.; zygomatic breadth 9·7; interorbital breadth 4·4; maxillary tooth-row 3·1; palatal foramina, greatest length 3·9.

Remarks.—This species is nearly related to the Asiatic *S. betulina* and the Central European *S. trizona* (assuming, in the absence of adequate material, these forms to be distinct species), but is easily distinguished from them by the yellower colour, dark nose and tail, and by the fact that the dorsal stripe forms a large black patch on the crown. The cranial material of *S. trizona* which has been examined has been very scanty, and, in view of this fact, the cranial distinctions given here may have to be modified in the future when more specimens of both species are forthcoming.

LVIII.—*On Two Abnormal Carapaces of* Carcinus mœnas, *Pennant.* By Michael Perkins, M.A., F.E.S.

Abnormalities of the carapace are exceedingly rare in *Carcinus*; I have observed only the two cases described below amongst about 4500 *C. mœnas* critically examined and many more casually inspected; similar irregularities have not been noticed among an equal number of other species of Brachyura from N.W. Europe. Both crabs were fished at Plymouth in June 1925, and, since they are very nearly of the same size, it is possible that both originated in the same genetic brood; but against this theory must be set the fact that the slightly larger specimen is female, and would therefore be expected to be somewhat smaller if of the same age, more especially because it was also parasitized by *Sacculina*.

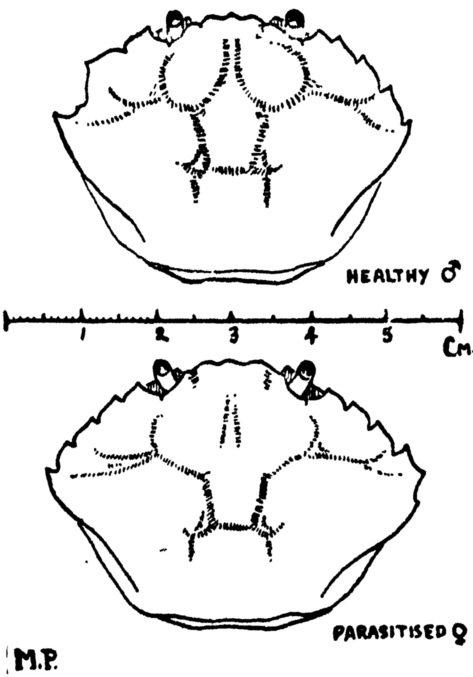
The healthy male may be described as having the first spine of the left antero-lateral margin enlarged, the second and third completely fused, and the fourth nearly suppressed; remainder of the carapace normal.

The parasitized female has an extra spine produced behind and on the fourth of the right antero-lateral margin, whilst the fifth is reduced and displaced; remainder normal.

The two cases are therefore of distinct types, the male showing suppression of differentiated ornament, the female having an increase of ornament through repetition.

It does not seem possible to associate these cases with either injury or parasitism.

Similar abnormal carapaces of crabs described by other authors include a male *Pugettia gracilis,* Dana (Inachidæ), with an extra spine on the left carapace (*Schmitt*), and a male *Hexapanopœus hemphili,* Benedict and Rathbun (Xanthidæ), "identified with some doubt, as both sides of the body are



Abnormal carapaces of *Carcinus mœnas*, Pennant.

infested with an isopod parasite which has so distorted the carapace that the lateral teeth are abnormal and unlike on the two sides" (*Rathbun*).

References.

M. J. Rathbun. (1921.) "Report on the Brachyura collected by the Barbados-Antigua Expedition in 1918." Univ. Iowa Studies, ser. 1, vol. ix. p. 70.

W. L. Schmitt. (1921.) "The Marine Decapod Crustacea of California." Univ. California Publ. Zoology, vol. xxiii. p. 206.

LIX.—*A Selection of Lectotypes of American Rodents in the Collection of the British Museum.* By OLDFIELD THOMAS.

THE confusion in which the taxonomy of American rodents was formerly involved was greatly increased by the quantity of co-types on which the species described by Gray, Waterhouse, and others were based. By degrees the confusion has been lessened, and the proper position of the different forms settled, but none the less, until a single specimen can be taken as the type of each name given, further confusion is always liable to arise, and can only be avoided by a definite selection of lectotypes, like that already published in the case of Australian mammals.

Such a selection I have now made for all the rodents of America, North and South, in the British Museum collection, so that in future only a single specimen will need to be referred to as a type. The case of the Patagonian Akodons cleared up by Dr. Allen is an instance of the great simplification of systematic work which comes of a proper selection of lectotypes, while the reduction in the crowd of specimens which are typical of Gray's many species of squirrels will make work on these difficult animals simpler and more satisfactory.

Dr. E. W. Nelson's important monograph † on the squirrels of Mexico and Central America has been of very great value to me in preparing the present paper, as it contains full references to Dr. Gray's many names, with a careful indication of their respective positions.

The new species in the historic collection of Muridæ made by Darwin during the voyage of the 'Beagle,' and worked out by Waterhouse, were also commonly based on a number of specimens, whence in some cases considerable confusion has arisen. For each of them a single lectotype is now selected.

I have done my best to make the list complete, but fear some will have been overlooked. To any such I should be glad to have my attention drawn.

The species are in all cases put under the names of the genera to which they would nowadays be referred, irrespective of the names under which they were described. Species for which lectotypes have already been selected, either by myself or other authors, are again repeated, so as to make the list as complete as possible.

† P. Wash. Ac. Sci. i. pp. 15–110 (1899).

Sciurus maurus, Gray.

Macroxus maurus, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 425 (1867).

59. 11. 1. 4. Oaxaca. Sallé.

Lectoparatype:
59. 11. 1. 5. Oaxaca. Sallé.

Synonymous with *S. aureogaster hypopyrrhus*, Wagl., *fide* Nelson.

Sciurus leucops, Gray.

Macroxus leucops, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 427 (1867).

58. 10. 22. 4. Oaxaca. Sallé.

Lectoparatype:
58. 10. 22. 4*. Oaxaca. Sallé.

Sciurus dorsalis, Gray.

Macroxus dorsalis, Gray, P. Z. S. 1848, p. 138, pl. vii.

♂. 48. 10. 26. 4. Probably Nicaragua. Sallé.

Lectoparatypes:
48. 10. 26. 5-6.

Sciurus griseoflavus, Gray.

Macroxus griseoflavus, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 427 (1867).

65. 5. 18. 47. Guatemala. O. Salvin.

Lectoparatype:
65. 5. 18. 49. Guatemala. O. Salvin.

Sciurus fraseri, Gray.

Macroxus fraseri, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 430 (1867).

50. 11. 28. 2. Ecuador. L. Fraser.

Lectoparatype:
59. 11. 28. 3 (imm.).

Considered by Allen to be synonymous with *S. stramineus*.

Sciurus boliviensis, Osg.

Macroxus leucogaster, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 430 (1867), nec *Sciurus leucogaster*, F. Cuv., 1831.
Sciurus boliviensis, Osg. J. Soc. Mamm. ii. p. 39 (1921).

47. 11. 22. 9. Sta. Cruz de la Sierra, Bolivia. T. Bridges.

Lectoparatype:
46. 7. 28. 63. Sta. Cruz de la Sierra, Bolivia. T. Bridges.

Sciurus irroratus, Gray.

Macroxus irroratus, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 431 (1867).

♂. 66. 3. 28. 8. Upper Ucayali, probably near Sarayacu. E. Bartlett.

Lectoparatypes:
66. 3. 28. 9 & 10.

Sciurus tephrogaster, Gray.

Macroxus tephrogaster, Gray, Ann. & Mag. Nat. Hist. (3) xx. p. 431 (1876).

♂. 56. 8. 1. 11. Mexico. Sallé.

Lectoparatypes:
45. 5. 15. 1; 46. 6. 29. 1; 65. 5. 18. 59 & 61. Honduras, "Bogota," and Guatemala.

Sciurus medellinensis, Gray.

Macroxus medellinensis, Gray, Ann. & Mag. Nat. Hist. (4) x. p 408 (1872).

♂. 72. 10. 22. 7. Antioquia, Medellin. J. K. Salmon.

Lectoparatype:
72. 10. 22. 8. Antioquia, Medellin. J. K. Salmon.

Sciurus paraensis, Goeldi.

Sciurus æstuans, var. *paraensis*, Goeldi, Bol. Mus. Goeldi, iv. p. 70 (1904).

♂. 5. 1. 25. 2. Para. Goeldi Museum.

Lectoparatype:
5. 1. 25. 3. Para. Goeldi Museum.

Already selected: Allen, Bull. Am. Mus. xxxiv. p. 262 (1915).

Citellus richardsoni, Sabine.

Arctomys richardsoni, Sabine, Trans. Linn. Soc. xiii. p. 589 (1822).

♂. 63 *a*. Carlton House, Saskatchewan. J. Sabine.

Lectoparatype:
63 *b*. Carlton House, Saskatchewan. J. Sabine.

The type of *Citellus franklini*, Sabine, was received at the same time—No. 61 *a*.

Citellus spilosoma, Benn.

Spermophilus spilosoma, Benn. P. Z. S. 1833, p. 40.

♂. 53. 8. 29. 5. California.

Lectoparatype:
55. 12. 24. 360.

Castor canadensis leucodontus, Gray.

Castor canadensis leucodonta, Gray, Ann. & Mag. Nat. Hist. (4) iv. p. 293 (1869).

Adult skull. 68. 3. 19. 5; 496 *b*. Vancouver Island. Dr. Brown.

Lectoparatypes:
Immature & young skulls. 68. 3. 19. 6 & 7. Vancouver Island. Dr. Brown.

All three skulls have whitish incisors, probably due to the chemical action of some cleaning agent used.

Neotoma ferruginea, Tomes.

P. Z. S. 1861, p. 282.

7. 1. 1. 124. Dueñas, Guatemala. O. Salvin.

Lectoparatypes:
7. 1. 1. 123, 125, 126, 127, adult & young. Dueñas, Guatemala. O. Salvin.

Nyctomys salvini, Tomes.

Hesperomys (Myoxomys) salvini, Tomes, P. Z. S. 1861, p. 285, pl. xxxi.

♂. 7. 1. 1. 93. Dueñas, Guatemala. O. Salvin. Tomes Collection.

Lectoparatypes:
7. 1. 1. 91, 92, 94. Dueñas, Guatemala. O. Salvin, Tomes Collection.

Considered to be a subspecies of *N. sumichrasti*, de Sauss.

Oryzomys couesi, Alst.

Hesperomys couesi, Alst. P. Z. S. 1876, p. 756.

75. 2. 26. 15. Coban. O. Salvin.

Lectoparatypes:
60. 2. 11. 8 & 70. 6. 20. 3.

Already selected: 1893.

Oryzomys nitidus, Thos.

Hesperomys laticeps, var. *nitidus*, Thos. P. Z. S. 1884, p. 452, fig.

♂. 85. 4. 1. 41. Amable Maria, Central Peru. C. Jelski. The specimen figured.

Oryzomys coppingeri, Thos.

Hesperomys (*Calomys*) *coppingeri*, Thos. P. Z. S. 1881, p. 4.

♂ in al. 79. 8. 21. 15. Cockle Cove, Trinidad Channel, Madre de Dios Island, W. Patagonia.

Oryzomys magellanicus, Benn.

Mus magellanicus, Benn. P. Z. S. 1835, p. 191.

55. 12. 24. 174. Port Famine, Magellan Straits. Capt. P. P. King. Received through the Zoological Society's Museum.

Lectoparatype:
55. 12. 24. 337. Zool. Soc. Mus.

Neacomys spinosus, Thos.

Hesperomys (*Calomys*) *spinosus*, Thos. P. Z. S. 1882, p. 105.

♂ in spirit. 81. 9. 7. 25. Huambo, N. Peru.

Lectoparatype:
81. 9. 7. 26, in alcohol.

Thomasomys taczanowskii, Thos.

Hesperomys (*Rhipidomys*) *taczanowskii*, Thos. P. Z. S. 1882, p. 109.

♀ skinned from spirit. 81. 9. 7. 23. Tambillo, Cajamarca. J. Stolzmann.

Lectoparatype:
Imm. ♂. 81. 9. 7. 22.

Phyllotis xanthopygus, Waterh.

Mus (*Phyllotis*) *xanthopygus*, Waterh, P. Z. S. 1837, p. 28.

55. 12. 24. 185. Sta. Cruz, Patagonia. C. Darwin.

Lectoparatypes:
55. 12. 24. 169 & 170. Port Desire.

Auliscomys pictus, Thos.

Rheithrodon pictus, Thos. P. Z. S. 1884, p. 457.

♂. 85. 4. 1. 34, in spirit. Junin. C. Jelski.
(*i* of the original series.)

Reithrodon cuniculoides, Waterh.

P. Z. S. 1837, p. 30.

55. 12. 24. 188. Sta. Cruz. C. Darwin.

Lectoparatypes:
Adult skull. 56. 12. 26. 112. Sta. Cruz. C. Darwin.
Immature. St. Julian. C. Darwin.
Immature. Port Desire. C. Darwin.

Hesperomys bimaculatus, Waterh.

Mus bimaculatus, Waterh. P. Z. S. 1837, p. 18.

55. 12. 24. 172. Maldonado. C. Darwin.

Lectoparatype (in al.):
55. 12. 26. 288. Maldonado. C. Darwin.

Akodon obscurus, Waterh.

Mus obscurus, Waterh. P. Z. S. 1837, p. 16.

55. 12. 24. 161. Maldonado. C. Darwin.

Lectoparatype:
55. 12. 24. 165. Maldonado. C. Darwin.

Akodon olivaceus, Waterh.

Mus olivaceus, Waterh. P. Z. S. 1837, p. 16.
Renamed *Mus renggeri*, Waterh. Voy. 'Beagle,' Mamm. p. 51 (1839).

55. 12. 24. 200. Valparaiso. C. Darwin.

Lectoparatypes:
55. 12. 24. 160 & 164. Coquimbo. C. Darwin.

Akodon canescens, Waterh.

Mus canescens, Waterh. P. Z. S. 1837, p. 17.

55. 12. 24. 157 †. Sta. Cruz. C. Darwin.

† Identified as typical of *A. canescens* by J. A. Allen, Mamm. S. Pat. p. 75 (1905), and accepted as lectotype by myself, Ann. & Mag. Nat. Hist. (9) iii. p. 205 (1919), where *A. iniscatus* was described.

Lectoparatype:
55. 12. 24. 173. Port Desire. C. Darwin.

This latter is an immature *A. iniscatus*, Thos.

Akodon xanthorhinus, Waterh.

Mus xanthorhinus, Waterh. P. Z. S. 1837, p. 17.

55. 12. 24. 158 †, immature. Hardy Peninsula, Tierra del Fuego. C. Darwin.

Lectoparatype:
55. 12. 24. 168. Capt. P. P. King.

Abrothrix brachiotis, Waterh.

Mus brachiotis, Waterh. P. Z. S. 1837, p. 17.

55. 12. 24. 167. Islet in Midship Bay, Chonos Archipelago. C. Darwin.

Lectoparatype:
55. 12. 24. 166. Islet off E. coast of Chiloe. C. Darwin.

This latter specimen is not an *Abrothrix*, but is referable to a species of *Akodon*.

Chelemys megalonyx, Waterh.

Hesperomys megalonyx, Waterh. P. Z. S. 1844, p. 154.

♂. 44. 10. 7. 37. L. Quintero, Chili. T. Bridges.

Lectoparatype:
43. 12. 30. 39. L. Quintero, Chili. T. Bridges.

Heteromys bicolor, Gray.

Perognathus bicolor, Gray, P. Z. S. 1868, p. 202.
Heteromys bicolor, Alst. Ann. & Mag. Nat. Hist. (5) vi. p. 118 (1880).

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† See Allen, *op. cit.* p. 72. That author was mistaken in stating that Waterhouse's "adult" example was no longer in the Museum, for it is the specimen above quoted as the lectoparatype. Its not being chosen as the lectotype is unfortunate, as it is more fully grown and is the one from which the original measurements in the P. Z. S. were taken, those of the Voy. 'Beagle' being based on the other, younger, specimen. But the selection does not now appear to be alterable. Owing to a *lapsus calami* on the label, the number of the lectotype was wrongly given as 55. 12. 24. 156 both by Allen and, later on, by myself, but there is no possible doubt as to its proper number and identity.

47. 2. 1. 7 †. Venezuela ‡. Dyson.

Lectoparatype:
47. 2. 1. 5. Venezuela. Dyson.

Heteromys melanoleucus, Gray.

P. Z. S. 1868, p. 204.

47. 2. 1. 4. Venezuela ‡. Dyson.

Lectoparatype:
47. 2. 1. 6. Venezuela. Dyson.

Heteromys albolimbatus, Gray.

P. Z. S. 1868, p. 205.

♀. 61. 11. 14. 9. La Parada, Oaxaca. Boucard.

Lectoparatype:
♀. 61. 11. 14. 10. La Parada, Oaxaca. Boucard.

Ctenomys leucodon, Waterh.

N. H. Mamm. ii. p. 281 (1847).

Adult, probably ♀. 46. 7. 28. 60. Machaca, La Paz, Bolivia. T. Bridges.

Lectoparatypes:
46. 7. 28. 59 & 61. Machaca, La Paz, Bolivia. T. Bridges.

Ctenomys boliviensis, Waterh.

N. H. Mamm. ii. p. 278 (1847).

♂ adult. 46. 7. 28. 57. Sta. Cruz de la Sierra. T. Bridges.

Lectoparatype:
♀. 46. 7. 28. 58. Sta. Cruz de la Sierra. T. Bridges.

Already selected: Ann. & Mag. Nat. Hist. (9) vii. p. 136 (1921) (vii. p. 285).

† By speaking in 1880 of the "type-specimen" in reference to 47. 2. 1. 7, Alston unconsciously selected it as the type (lectotype), and we cannot now choose 47. 2. 1. 5, even though it be the better specimen.
The name *bicolor*, as having two pages' priority, would seem to be the proper term for the Venezuelan *Heteromys* that has since been called *H. melanoleucus*. The two names were based on four specimens, lectotype and lectoparatype of each, all received together in the same collection.
The soft-haired *bicolor* is presumably an immature stage of the spinous *melanoleucus*.

‡ Wrongly published as Honduras.

Aconæmys fuscus.

Schizodon fuscus, Waterh. P. Z. S. 1841, p. 91.

♀. 55. 12. 24. 195. Valle de las Cuevas, near Peteroa, E. side of Andes, Chili.

Lectoparatype:
55. 12. 24. 194 in coll.

Octódon bridgesi, Waterh.

P. Z. S. 1844, p. 155.

♀. 55. 12. 24. 196. Rio Teno, Colchagua. T. Bridges.

Lectoparatype:
43. 7. 20. 5. Rio Teno, Colchagua. T. Bridges.

Abrocoma cuvieri, Waterh.

P. Z. S. 1837, p. 32.

Immature. 55. 12. 24. 186.

Lectoparatype:
55. 12. 24. 187.

(Unquestionably the young of *A. bennettii*.)

Proechimys brevicauda, Günth.

♀. 69. 3. 31. 7. Chamicuros, Huallaga. E. Bartlett.

Lectoparatype:
♂ in spirit. 66. 1. 29. 8. Upper Amazons. E. Bartlett.

Already selected: Ann. & Mag. Nat. Hist. (7) vi. p. 301 (1900).

Coendou pallidus, Waterh.

Cercolabes pallidus, Waterh. N. H. Mamm. ii. p. 434 (1848).

Young. 46. 1. 9. 14.

Lectoparatype:
42. 10. 7. 15.

Dasyprocta isthmica, Alst.

P. Z. S. 1876, p. 347.

♀. 98. 10. 25. 2. Panama. Zool. Soc

Lectoparatype:
♂. 98. 10. 25. 1. Panama. Zool. Soc.

Galea boliviensis.

Cavia boliviensis, Waterh. N. H. Mamm. ii. p. 175 (1847).

45. 11. 18. 22. Bolivia.
Selected: Ann. & Mag. Nat. Hist. (8) viii. p. 254 (1911).

Lepus californicus, Gray.

Ann. & Mag. Nat. Hist. i. p. 586 (1837).

53. 8. 29. 30. "St. Antoine," California. D. Douglas. Zool. Soc. Museum.

Lectoparatypes:
53. 8. 29. 31 & 55. 12. 24. 97. "St. Antoine," California. D. Douglas. Zool. Soc. Museum.

Sylvilagus douglasi, Gray.

Lepus douglasi, Gray, Ann. & Mag. Nat. Hist. i. p. 586 (1837).

92 *a*. "Texas?" Purchased (1836) of Mrs. Drummond.

Lectoparatype:
92 *b*. "Texas?" Purchased (1836) of Mrs. Drummond.

LX.—*A new Bat of the Genus* Myotis *from Abyssinia.* By OLDFIELD THOMAS.

THE National Museum owes to Dr. H. H. Scott of Cambridge a number of bats of the genus *Myotis* obtained by him near Addis Ababa, Abyssinia. The species was at first supposed to be Monticelli's *Vespertilio dogalensis* *, a native of Aden, but, by the kindness of Dr. Gestro, the type of that species, the property of the Museo Civico, Genoa, has been sent to me for comparison, and I now find Dr. Scott's bat to be new. It may be called

Myotis scotti, sp. n.

Size medium, general colour approaching that of *M. bocagei*, although not so bright—in fact, even more like *M. b. cupreolus* of the W.-African forest-region. Upper surface broadly washed with coppery rufous. Under surface dull whitish at the ends of the hairs, dark slaty at their bases. Ears of medium size, rather narrow, their outer edge with a

* Ann. Mus. Genov. (2) v. p. 518 (1887).

slight emargination. Tragus rather short, straight, with well-marked outer basal lobule. Tail and interfemoral membrane of unusual proportional length, the tip of the tail not or scarcely projecting; calcar not long, reaching about half the distance towards the tip of the tail; feet short, wing-membrane inserted at the base of the outer digit. Membranes everywhere blackish.

Skull with a peculiarly high brain-case, sloping down abruptly to the low muzzle, in marked contrast to the even slope in *M. bocagei.* Teeth small, the canines very short, only about 1·2 mm. from the cingulum to the tip, while in *bocagei* and in the type of *dogalensis* this measurement is about 1·6 mm. The two small premolars in the line of the tooth-row, the posterior about two-thirds the area in cross-section, and half the height of the anterior.

Dimensions of the type :—

Forearm 38 mm.

Skull: greatest length 14·5 ; condyle to front of canine 12·7 ; breadth of brain-case 7·4 ; height from bulla to crown 6·5 ; front of canine to back of m^3 5·5.

External measurements of a spirit-specimen (male):—

Forearm 40 mm.

Head and body 42 mm.; tail 40; ear 14·5 ; tragus 5; third finger, metacarpal 39, first phalanx 15 ; lower leg and hind foot (c. u.) 25·5, foot (c. u.) from hinder side of calcar 6·8 ; calcar 10.

Hab. of type-series. Djem-Djem Forest, about 40 miles W. of Addis Ababa, Abyssinia. Alt. 8000′.

Type. Adult male, skinned from spirit. B.M. no. 27. 3. 4. 1. Six specimens.

The type of *dogalensis* proves to be decidedly immature, and I am by no means satisfied that it is specifically distinct from *M. bocagei,* but adult topotypes will be necessary before this point can be settled. The new form differs from *bocagei* by its smaller size, shorter feet, its unusually long tail, its vaulted abruptly sloped skull, and its short canines. In all these points the type of *dogalensis* appears to agree with *bocagei* so far as can be made out on an immature specimen.

I can find no other African species to which *M. scotti* has any resemblance.

Dr. Scott's name is already connected with bats by his work on their parasites, and I have now much pleasure in connecting it with the new species which he has discovered. He tells me that all the specimens were found in the rolled-up leaves of banana-plants.

LXI.—*The Octodon of the Highlands near Santiago.* By OLDFIELD THOMAS.

THE British Museum has possessed for some years series of Octodons presented by Mr. J. A. Wolffsohn, who obtained them at various localities on the low ground from Santiago to Valparaiso, these clearly representing the original *O. degus* of Molina (synn. *cumingii*, Benn.; *pallidus*, Wagn.). In addition, he collected a series from Puente Alto, on the comparatively high ground to the east of Santiago, and these I should now consider to represent a special highland race, which might be called

Octodon degus clivorum, subsp. n.

Size slightly greater than in *O. degus*, but less than in *O. bridgesii*. Colour markedly colder and more greyish than in the warm brown *O. degus*. General colour above near "light greyish olive" of Ridgway, typical *degus* being more "buffy brown." Under surface washed with dull yellowish white, with but little trace of the distinctly buffy or even ochraceous wash of *degus*. No axillary or inguinal white patches, such as are commonly present in *O. bridgesii*.

Skull essentially similar to that of *degus*, though rather larger.

Dimensions of the type:—

Head and body 183 mm.; tail 134; hind foot 37; ear 30.

Skull: greatest length 44; condylo-incisive length 41·7; zygomatic breadth 23·6.

Hab. of typical series. Puente Alto, E. of Santiago. Altitude 800 m.

Type. Adult male. B.M. no. 4. 1. 7. 13. Original number 262. Collected 30th November, 1903. Ten specimens.

When sending his Octodons, Mr. Wolffsohn gave me a remarkable account of the different species of rodents which occur living together in this region, as from the same holes he captured *Octodon degus*, *O. bridgesii*, *Abrocoma bennettii*, *Phyllotis darwini*, *Akodon olivaceus*, *Abrothrix longipilis*, *Oryzomys longicaudatus*, and *Rattus rattus*; besides *Marmosa elegans* (letter of 30th July, 1909).

Apropos of *Octodon*, I may take this opportunity of recording that by the great kindness of Dr. Otto Fuhrmann, of Neuchatel, I have been able to examine the specimen of "*Octodon cummingii*, var. *peruana*," recorded by Tschudi as

found by him at San Juan de Matucana, alt. 9000′, a place just to the east of Lima, Peru. The specimen proves in every detail of size and colour to be so exactly like ordinary Valparaiso specimens of *O. degus* that I must frankly express my disbelief that it ever lived in Peru, unless as a pet. I may note that Matucana is quite close to localities where such first-class collectors as Perry Simons and Russell Hendee have made collections, and that no similar animal has been obtained by them.

The "Peruvian" specimen has no skull, but even without that I am convinced that the animal can only be referred to the Chilian *Octodon degus.*

LXII.—*Three new* Acrididæ *from the Marquesas and Rapa Islands.* By B. P. Uvarov, Imperial Bureau of Entomology.

The following new Acrididæ are being described from the material brought to the British Museum by Miss E. Cheesman and Mr. C. L. Collenette, members of the 'St. George' Expedition.

Ootua, gen. nov.

A member of the group Cyracanthacrini, allied to *Melicodes,* Uv., and *Gowdeya,* Uv., but different from both in a number of important characters.

Antennæ very long and slender. Frontal ridge in profile distinctly reclinate, especially in the male; seen from the front it is parallel-sided, not at all narrowed at fastigium, neither widened between antennæ; its surface punctured and impressed; margins low, irregular, obsolescent near clypeus. Face coarsely punctured and rugulose. Fastigium of vertex short, sloping, forming a well-rounded angle with the frontal ridge; surface feebly impressed; margins obtuse, punctured. Eyes elongate-oval, their height in the female exceeds the subocular distance by a little, in the male distinctly so; distance between the eyes subequal to the width of the frontal ridge.

Pronotum rounded, distinctly compressed laterally, with a coarse honeycombed sculpturation; the disc strongly convex in transverse direction; median keel scarcely perceptible, interrupted by the sculpturation; lateral lobes

decidedly longer than high. Prosternal tubercle straight, acutely conical, very slightly inclined backwards. Mesosternal lobes a little longer than broad; their inner margin straight; inner angle right in the female, slightly obtuse in the male.

Elytra not reaching the apex of the abdomen; their membrane transparent everywhere; veinlets in the basal part incrassate, but not confluent; apex elliptical; anterior margin strongly expanded basally. Wings distinctly shorter than elytra, round.

Front and middle legs slender, elongate. Hind femora relatively slender, gradually narrowed towards the apex; upper keel very feebly projecting, faintly serrulate; externo-median area flat; lower external keel straight. Hind tibiæ with nine outer and ten inner spines.

Genitalia of the same general type as in *Valanga*.

Genotype: *Ootua antennata*, sp. n.

In its general appearance the new genus reminds more of *Gowdeya* than of *Melicodes*, but its long antennæ, elongated pronotum, short elytra, and short round wings make it look different from any known genera of Cyrtacanthacrini, except, perhaps, *Phyxacra* or *Acridoderes*, which, however, differ abundantly in the structure of the head, reticulation of elytra, and other important characters.

The best diagnostic character of the new genus is the shape of the anterior margin of elytra, with its strong basal expansion.

Ootua antennata, sp. n. (Fig. 1.)

♂ (type). Size under medium for the group.

Antennæ fine, reaching distinctly beyond the middle of elytra, composed of very long joints. Pronotum long, with equally strong honeycombed sculpturation all over; transverse sulci two, not very strong, while the anterior one is quite obsolete; anterior margin obtusely rounded, with a shallow notch in the middle; prozona distinctly longer than metazona, which is elliptical behind. Elytra reaching the supra-anal plate; wings by one-fourth shorter than elytra.

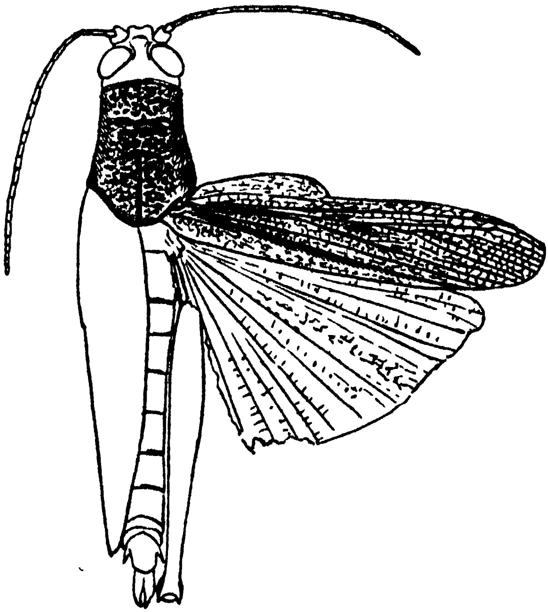
Supra-anal plate elongate-trapezoidal, distinctly longer than broad; apex with a broad triangular projection; surface with a pair of submarginal tubercles before the middle, with a slightly raised and feebly sulcate median ridge and distinct depressions at the outer angles. Cerci slightly longer than the plate, a little compressed; seen from above strongly incurved; seen from the side sinuate,

narrowed towards the apex which is somewhat decurved, subgenital plate recurved, short conical.

General coloration greenish olivaceous (probably pure green in life). Wings somewhat infumate. Hind tibiæ with brownish dots ; spines black-tipped.

♀ (paratype). More robust than the male. Antennæ reaching the base of hind femora. Pronotum with the anterior sulcus expressed, though not strongly so. Valvæ of the ovipositor without teeth.

Fig. 1.



Ootua antennata, gen. et sp. n., ♀.

Total length, ♂ 37, ♀ 51 mm.; pronotum, ♂ 10, ♀ 13; elytra, ♂ 22, ♀ 32; wings, ♂ 18, ♀ 26; hind femur, ♂ 23, ♀ 29.

Described from one male and one female taken near the Ootua Mountain, Hiva-oa, Marquesas Islands, January 1925, by Miss E. Cheesman.

Six larvæ of different stages have been taken together with the described adults. The smaller larvæ are very strikingly marked with black and yellow, exhibiting a type of coloration common to nearly all larvæ of swarming species of

Acrididæ, although, according to Miss Cheesman, they were not numerous.

Miss Cheesman was kind enough to give the following note on the habitat of this insect :—

"The greater part of Hiva-oa consists of an elevated plain from 2000–3000 ft. above sea-level, cut into very deeply by heavily forested valleys. The plain is covered with extensive belts of scrub, intersected by large areas of *Pteris* where the ground has been burnt over. The conditions generally were dry, and insects were scarce, several species æstivating.

"Towards the N.E. of the plain, small isolated depressions were to be met with where the soil was moister, with groups of a tall Pepper and patches of green grass. In one of these verdant localities, at about 2200 ft., at the foot of the crags of Mount Ootua, eight specimens of *Ootua antennata* were taken. Some half-grown larvæ, the earlier stages very brilliantly coloured in vermilion, yellows, and greens, were sitting openly on the branches of *Paritium tiliaceum* ; upon another tree of the same species a few yards distant the ♂ was stridulating in concealment, and the ♀ was beaten out of the branches upon the further side of the tree."

Valanga rapana, sp. n. (Fig. 2, A, B.)

Similar and allied to *V. rouxi*, Willemse, but somewhat larger, more robust, and more rugosely sculptured.

♂. Face rugulose. Frontal ridge coarsely punctured, impressed from the ocellum downwards. Cheeks rugulose at the lower front angle. Fastigium of vertex short, transverse, surface scarcely impressed and slightly rugulose near the margins ; the latter thick, punctured.

Pronotum compressed laterally, well rounded above, strongly honeycombed-punctured and rugose, more densely so in metazona ; anterior margin very slightly convex, entire; hind angle obtuse and rounded ; median keel very low, made irregular, but not interrupted, by the sculpturation, seen in profile practically straight.

Prosternal spine slightly inclined backwards, with the anterior margin more convex than the posterior, narrowed at the rounded apex.

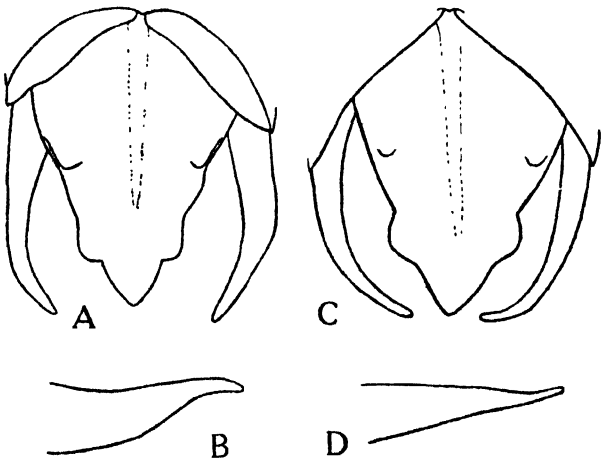
Hind femora rather stout, typical for the genus. Hind tibiæ with nine internal and eight external stout spines, the latter scarcely shorter than the former.

Supra-anal plate narrowed backwards, with a triangular apical projection and obtuse rounded pre-apical angles;

surface raised along the middle and sulcate at the median line; a pair of very distinct obtusangulate plate-like teeth at the lateral margins before the middle. Cerci a little longer than the plate, strongly compressed laterally, seen from above somewhat incurved, in profile strongly narrowed towards the apex which is slightly decurved. Subgenital plate elongate, acutely-conical.

General coloration dark brown. Antennæ towards the apices olivaceous. Elytra with a few fairly large brown spots. Wings slightly infumate. Hind femora with scarcely perceptible darkish fasciæ above and with series of blackish

Fig 2.



A & B. *Valanga rapana*, sp. n., ♂.
C & D. *V. marquesana*, sp. n., ♂.

dots along the carinæ of the externo-median area. Hind tibiæ vinaceous-red, spines orange, broadly black-tipped.

Total length 37 mm.; pronotum 8·5; elytra 34; hind femur 22 mm.

A paratypic male differs from the type in an uniformly olivaceous-yellow coloration, without spots on the elytra; hind femora only with bluish-grey dots on the external carinæ; hind tibiæ reddish, spines yellow, black-tipped. The general build is slightly more slender than in the type and the sculpturation a trifle less strong.

Described from two males taken in April 1925 at the Rapa Island by Mr. C. L. Collenette.

Valanga marquesana, sp. n. (Fig. 2, C, D.)

Similar to *V. rapana*, but more slender.

♂. Face dull, obsoletely punctured. Frontal ridge with faint punctures along the margins and near the fastigium, strongly sulcate throughout. Cheeks very slightly rugulose below. Fastigium of vertex elongate, but broadly rounded at the apex; surface compressed; margins practically smooth.

Pronotum compressed laterally, very convex above, strongly punctured-rugulose, but not regularly honeycombed, except in the posterior portion of lateral lobes; anterior margin feebly convex, entire; hind margin obtusangulate, only the immediate angle rounded; median keel itself very low and made irregular by the sculpturation, but in profile distinctly convex, owing to the longitudinal gibbosity of the whole pronotum.

Prosternal spine inclined backwards; when seen in profile its front margin straight and the hind margin distinctly convex; apex narrowed, rounded.

Hind femora more slender than it should be in a *Valanga*. Hind tibiæ with 9–10 external and 12 internal spines, all relatively slender, those of the internal series decidedly longer and more slender than the external ones.

Supra-anal plate strongly narrowed backwards, with a broad triangular apical projection and well-rounded preapical lateral projections in place of angles; surface raised in the middle, sulcate along the median line; a pair of obtuse rounded tubercles at the lateral margins before the middle. Cerci distinctly longer than the plate, but, seen from above, strongly incurved; in profile gradually narrowed towards the apex, practically straight. Subgenital plate narrowly conical.

General coloration pale brownish yellow, without any pattern. Hind femora unicolorous. Hind tibiæ pale yellow, spines of the same colour, black-tipped. Wings hyaline.

Total length 40 mm.; pronotum 9; elytra 39; hind femur 22.

Described from a single male taken in dry scrub on the slopes above the valley Tai-pai, Nuka-hiva, Marquesas Islands, by Miss E. Cheesman.

These two new species of *Valanga* are allied to *V. rouxi*, Will., from New Caledonia, and the following key may be used to separate them:—

1 (4). Pronotum with the median keel in profile straight. Hind femora stout,

with at least series of dark dots along the external carinæ. Hind tibiæ wholly or partly red, armed with 6-8 external and 9 internal spines. Male cerci in profile strongly narrowed towards the decurved apex.

2 (3). Pronotum not strongly punctured. Hind tibiæ bluish, with the base yellowish and the apex red; spines red, the internal ones long and straight. Supra-anal plate of the male without sublateral teeth.—New Caledonia ...... *V. rouxi* (Will.).

3 (2). Pronotum very strongly honeycombed-punctured. Hind tibiæ vinaceous-red; spines orange, the internal ones short and curved. Supra-anal plate of the male with plate-like sublateral teeth.—Rapa Isl. .... *V. rapana*, sp. n.

4 (1). Pronotum with median keel in profile convex. Hind femora slender, unicolorous. Hind tibiæ yellow, with 9-10 external and 12 internal spines. Male cerci in profile narrow, practically straight. Male supra-anal plate with round sublateral tubercles.—Marquesas Isl. .... *V. marquesana*, sp. n.

LXIII.—*On a new Species of* Delias *from Mindanao, Philippine Islands.* By Lord ROTHSCHILD, F.R.S., Ph.D.

Delias levicki, sp. n.

♀. Nearest to *D. splendida*, Rothsch., from Oinainisa.

Differs above in having the basal $\frac{3}{5}$ of fore wing cream-white, not black, the basal $\frac{2}{3}$ of cell more thinly scaled and showing black of underside through; apical $\frac{2}{5}$ of wing black, with curved fascia of cream spots much smaller than in *splendida*, only the one below vein 2 large and coalescing with white of inner $\frac{3}{5}$ of wing; hind wing as in *splendida*, but outer black area broader, and the inner cream area is washed with grey. Below it is very different; fore wing yellowish olive-green, basal $\frac{2}{3}$ of cell black, powdered with olive-green, outer $\frac{1}{3}$ cream-colour; a curved black band across wing beyond cell powdered with yellowish olive; area between veins 2 and 4 more yellow and below vein 2 blackish; hind wing pale olive-green freckled slightly with black scales.

Expanse 80 mm.

Hab. Mindanao (*J. Waterstradt coll.* 1903–1904). Type ♀ in Tring Museum (ex coll. Levick, ex coll. Oberthür).

LXIV.—*Contributions towards a Knowledge of the European Thysanoptera.*—II. By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THIS is continued from Ann. & Mag. Nat. Hist., ser. 9, vol. xviii. pp. 641–661 (Dec. 1926), and contains the descriptions of *Chirothrips meridionalis*, sp. n., *C. aculeatus*, sp. n., *Dendrothripiella phyllireæ*, gen. et sp. n., *Anaphothrips debilis*, sp. n., *Oxythrips nobilis*, sp. n., *Thrips dyssochætus*, sp. n., *Brachythrips terminalis*, sp. n., *Cryptothrips brachyurus*, sp. n., and *Liothrips amabilis*, sp. n., as well as records of several interesting species, of which *Odontothrips ulicis*, Hal., and *Thrips euphorbiicola*, Bagn., are for the first time recorded outside of the British Isles.

Most of these discoveries are due to a recent journey to the South of France, where, despite many days of torrential rain, I found opportunities of collecting in the neighbourhood of Toulon (Tamaris-sur-Mer), Hyères (L'Almanarre, Gien, etc.), Villefranche, Cap Ferat, and Eze, with also a brief visit to the Italian Riviera.

The most interesting capture of all—namely, a species of *Amphibolothrips* (Urothripoidea) in large numbers—will be dealt with in another part.

Superfamily **ÆOLOTHRIPOIDEA**.

Family **Æolothripidæ**, Uzel (s. str.).

Æolothrips ericæ, Bagn.

Hab. ITALY, Atrio del Cavallo (Vesuvio), Resina (Napoli), 2 ♀ ♀, 1 ♂, on *Genista*, June 1917 (*C. Menozzi*). FRANCE, Arcachon, on *Erica*, Aug. 1926; Eze, Cap Ferat, and Villefranche, on *Rosamarinus*, April; and Tamaris, on *Erica arborea*, March 1927.

Æolothrips mülleri, Pr.

Hab. SWITZERLAND, Zurich, in flowers of *Lotus*, ♀ ♀ only, July 1925. ITALY, Portici, 2 ♀ ♀ in *Verbascum* with *Æ. tenuicornis*, Bagn. FRANCE, Wimereux, on *Lotus*, July 1925.

Previously known from Austria and Great Britain.

Æolothrips tenuicornis, Bagn.

Apparently attached to *Verbascum* spp.

I have found it in SWITZERLAND, FRANCE (North and South), ANDORRA, and SPAIN, and have had it submitted to me from ITALY (*Menozzi*).

Æolothrips similis, Pr.

SWITZERLAND, Uetliberg, Zurich, on *Fraxinus*, ♀ ♀ only, July 1925.

Æolothrips melaleucus, Hal. (Bagn., nec Uz.).

SWITZERLAND, Zurich, in the Sihlwald on *Alnus*, 1 ♀, July 1925.

Rhipidothrips gratiosus, Uz.

SWITZERLAND, Zurich, near the summit of the Uetliberg, on oats, and FRANCE, Wimereux, on oats, July 1925.

Previously known from Bohemia and the south of England only.

Family **Franklinothripidæ**, Bagn.

Franklinothrips megalops (Tryb.), Bagn.

1924. *Franklinothrips myrmicæformis*, Zanon, Atti della Pontificia Accad. delle Scienze Nuovi Lincei, lxxvii. pp. 2–9 (? sep.), figs.

When I published my memoir (Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pp. 168–173) on the new family Franklinothripidæ I was not aware of Zanon's careful description cited above, from which it is evident that his *F. myrmicæformis* is the (then unknown) ♀ of *F. megalops* described by me as such in January 1926. Through Dr. Zanon's kindness, I have now had the additional satisfaction of confirming this view by the examination of his type. It is a striking addition to the fauna of the Mediterranean basin.

Superfamily **THRIPOIDEA.**

Family **Thripidæ**, Uz.

Chirothrips hamatus, Tryb.

Hab. FRANCE, Wimereux, 1 ♀ by beating grass on sandhills, July 1925.

Chirothrips meridionalis, sp. n.

♀.—Length about 1·2 mm.

Form slender. Grey-brown to brown; head, abdominal segments 9 and 10, and antennal segments 5–8 dark blackish-brown. Thorax with considerable yellowish-orange hypodermal pigmentation. Fore-tibiæ and all tarsi yellowish, all femora and hind- and intermediate-tibiæ more or less darkly shaded to grey-brown, lightest on their inner and darkest at their outer margins. Antennæ with joint 1 lighter than the head, 2 pale brownish-yellow, 3 yellow, and 4 greyish-yellow to pale yellow-brown. Wings lightly fumate.

Head laterally not prolonged beyond the anterior margins of eyes, but produced in the form of a hump between the seating of the antennæ. Length of head behind eye 0·5 (or slightly less) the length of the eye; posterior ocelli larger than the anterior ocellus and situated near the inner posterior angles of the eyes. Antenna with joint 2 dentiform, not strongly produced as in the species *aculeatus*, *manicatus*, and *similis*, but more as in the third antennal joint of *Limothrips denticornis* ♂ figured in Part I. of this series; joint 3 asymmetrical, with the outer margin strongly and roundly bulging and carrying near apex a long, stout, slightly curved, simple trichome. Pronotum 1·25 times as broad as long and 1·75 times as broad as the head. Fore-tibia nearly twice as long as broad. Wings slender, fore-wings nearly twenty times as long as median width (675 : 35 μ); longitudinal veins distinct, costa with c. 20, upper vein with 1 near middle and 1 + 1 in distal fourth, and lower vein with 6 more or less regularly set setæ.

Length of head to a line across anterior margin of eyes 89 μ; of median production 38 μ; of eye and cheek 65 and 24 μ respectively. Width across eyes and at base 116 and 122 μ respectively. Length (and breadth) of pronotum 162 (202) μ; length of bristles at posterior angles 38–46 μ. Longest bristles of abdominal segments 9 and 10, 100 and 95 μ respectively.

Readily distinguished by its slender form and distinctive coloration and the form of the second antennal joint.

Hab. France, on a grass, *Brachypodium ramosum*, ♀♀ only; Eze and Villefranche, apparently common. Italy, Ventimiglia, 1 ♀, Feb. 1927.

Chirothrips similis, Bagn.

Chirothrips molestus, Priesner, 1926, 'Die Thysanopteren Europas,' pt. 1, p. 142.

I have taken a brachypterous form in the Eastern Pyrenees. Priesner describes his *C. molestus* from Upper Austria under the impression that the following species was the true *C. similis*.

Hab. France, Wimereux, July 1925, and L'Hospitalet, on *Festuca*, 5500 ft., vii.–viii. 26 ; Spain, Puigcerda, on *Avena*, viii. 26, both winged and brachypterous forms as also at L'Hospitalet. Switzerland, Zurich district, July 1925. Norway, Bygdø, near Christiania, June 1909.

Chirothrips aculeatus, sp. n.

Chirothrips similis, Priesner (nec Bagnall), *l. c.* p. 142 (where it is fully described).

Readily separated from *similis* by the long pointed end of the abdomen. The costal setæ of the fore-wing are very noticeably longer and finer than in *similis*.

Priesner records it from Austria and Hungary, whilst I have found it in Italy and Southern France. Moulton has taken it in North America. Navas has sent it to me from Spain (Arnes, Tarrogona), 28. viii. 13.

Limothrips cerealium, f. *aptera*.

Hab. S. France, Almanarre, near Hyères, ii. 27, ♀ ♀ on a *Juncus* at edge of salt-marsh.

Genus Dendrothripiella, nov.

As in *Dendrothrips*, but with the antenna 7-jointed, the joints 5 to 7 broadly united and together forming a compact elongated conical mass.

Type. *Dendrothripiella phyllireæ*, mihi.

Dendrothripiella phyllireæ, sp. n.

♀.—Length about 1·0 mm.

Yellow, head and thorax more deeply coloured and shaded with grey to grey-brown, the sides of the pterothorax being the darkest ; eyes black, ocelli with crimson crescentic pigmentation ; wings of a uniform pale greyish-yellow ;

antenna with joint 1 white, 2 brown, 3 and 4 yellow, and 5–7 dark brown.

Very close to *Dendrothrips saltator*, Uz., from which it differs in its broader form, in the structure of the antennæ noted above, and which are also markedly stouter, in the unicoloured pronotum and the light-coloured wings, and the much more minute colourless seta (7 μ as compared to 17 μ in *saltator*) at each hind angle of the pronotum.

The antenna has joint 2 massive and armed with two spines near apex within.

Length (and breadth) of head and pronotum 80 (162) and 94 (190) μ respectively; length (and breadth) of antennal joints 3–7 approximately as follows:—

$$32\ (19) : 32\ (19) : 30\ (18) : 32\ (12) : 7{\cdot}5\ (4)\ \mu.$$

Hab. FRANCE, on *Phyllirea angustifolia*, near Hyères-la-Plage, in numbers, and Cap Ferat, February 1927, ♀♀ only.

Anaphothrips debilis, sp. n.

♀.—Length about 1·1 mm.

Brachypterous, very slender, as in *A. gracillimus*, Pr., to which species it is closely allied.

Colour pale yellow, mouth-cone grey-brown to brown, and extreme tip of abdomen brownish; eyes black, ocelli small, with slight crimson pigmentation. Antenna with joint 1 whitish, 2 greyish-brown to brown, 3 pale yellow, 4 pale greyish-yellow, 5 light greyish-brown, and 6 to 8 brown, with 6 inclined to be paler basally. Wing-pad grey.

Relative lengths (and breadths) of antennal joints 2 to 8 approximately as follows:—

$$32\ (27) : 35\ (19) : 32{\cdot}5\ (19) : 34\ (20) : 48\ (19) : 10 : 13{\cdot}5\ \mu.$$

Length of head and breadth across eyes 108 and 144, as compared with 108 and 122 μ in *gracillimus*; length (and breadth) of pronotum 135 (170) as compared with 119 (119) μ in *gracillimus*; and breadth of abdomen at segment 5 243 compared with 221 μ in *gracillimus*. Postero-marginal pronotal setæ shorter than in *gracillimus*, the longest only 15 to 16 μ compared with 27 μ, and the length of the bristles of abdominal segment 9 about 98 μ or approximately the same as in *gracillimus*.

Comb of abdominal tergite 8 complete but short, the cilia broad at base and averaging c. 13 μ in length.

This species undoubtedly comes very close to *gracillimus*, Pr., from which it may be readily separated by its stouter antenna, which has joint 2 brown (yellow in *gracillimus*), its broader head and transverse pronotum, the shorter pronotal setæ, and the short comb of the eighth abdominal tergite, which is described as very long in *gracillimus*.

Hab. FRANCE, L'Almanarre, near Hyères, ♀ ♀ from *Juncus* sp. growing at the edge of a salt-marsh, Feb. 1927.

Oxythrips nobilis, sp. n.

This fine species is allied to *brevistylis*, Tryb., but comes in a new section, wherein the species not only have the abdominal segment 10 elongated and tubiform, but also have the sixth joint of the antennæ divided by an obscure obliquely transverse suture (as in the American species *divisus*, Hood, and *zeæ*, Moulton).

♀.—Length 1·5–1·6 mm.

Yellowish-brown to grey-brown; head and abdomen of a more uniform dark grey-brown. Antenna with joints 1 and 2 greyish-yellow to light yellow-brown, 3 grey-brown with a pale ring at extreme base before stem, which is greyish-yellow; 4–8 of a uniform dark grey-brown. Fore-wings uniformly lightly fumate.

Head transverse, cheeks diverging basally; mouth-cone both massive and long, as long as or slightly longer than the breadth at base, and overreaching the base of prosternum. Posterior ocelli noticeably larger than the anterior ocellus; inter-ocellar bristles long (c. 54 μ). Maxillary palpi with joint 2 markedly shorter than 1 and 3 (c. 30 ; 14 : 24 μ). Antenna about 2·0 times as long as the head, slender. Relative lengths (and breadths) of joints 3–8 approximately as follows:—

49 (23) : 43 (21) : 38 (21) : 59 (20) : 11 : 16 μ.

Pronotum a little longer than the head and about 0·7 as long as broad, bristle at each posterior angle curved, 0·4 to 0·45 the median length of the pronotum. Fore-wing about fifteen times as long as width near middle, costa with 30 and lower vein with 14–16 setæ, upper vein with a basal series of 3–4 + 4–5 and distal half with 6 or 7 irregularly spaced setæ.

Body elongate, sharply narrowing from segment 7 to the long tubiform tenth segment.

Length of head to across the anterior margin of eyes

140 μ, width across eyes and at base 190 and 210 μ respectively; length (and breadth) of pronotum 162 (224), and length of postero-angular bristle 65–72 μ; length (and breadth) of fore-wing 1000 (67) μ; length (and breadth at base) of abdominal segment 10, 146 (62), and length of longest bristles on 9 and 10, 100 and 68 μ respectively.

Hab. FRANCE and ITALY. In the ♂ flowers of the Aleppo pine (*Pinus halepensis*) presumably throughout the French and Italian Riviera, ♀ ♀ only. I have taken it at San Remo, Menton, Eze, Villefranche, and Cap Ferat, and my friend Mons. Jacques Frotièe has sent it to me from the latter localities.

Euphysothrips menozzii, nom. emend.

Euphysothrips minozzii, Bagnall, 1926, in error.

Scolothrips longicornis, Pr.

1926. Priesner, Die Thysanopteren Europas, p. 239.

Hab. FRANCE, Font Romer, 5500 feet, on *Juniperus*, and near Perpignan, on *Frankenia* (with *Thrips frankeniæ*, Bagn.). ANDORRA, on the Soldeu Road at c. 6000 feet, and SPAIN, near Puigcerda, on *Juniperus*, ♀ ♀ only, Aug. 1926.

Odontothrips ulicis, Hal. (Bagn., nec Uzel).

Hab. FRANCE, common on *Ulex europæa* near Boulogne, July 1925.

This is the first authentic record of the true *ulicis* from outside the British Isles.

Thrips dyssochætus, sp. n.

Belonging to the *tabaci-nigropilosus* group.

♀.—Of the same general colour, size, and form as *T. nigropilosus*, Uz. Antenna with joint 1 pale greyish-yellow, 2, 6, and 7 grey-brown, 3 paler, and 4 and 5 inclined to be paler distally; all bristles dark. Wings short reaching only to the 7th abdominal segment; bristles of the fore-wing long; costa and lower vein with 15–16 and 8–10 respectively, and upper vein with 1 near middle and 1 + 1 (or 0 and 1 + 1 or 1 + 1 + 1) distally.

Relative lengths (and breadths) of antennal joints 2–7 approximately as follows:—

32 (24) : 44 (19) : 40 (19) : 35 (18) : 43 (19) : 14 (7) μ.

Length of outer and inner postero-angular pronotal setæ

46 and 57 μ respectively; three pairs of inferior postero-marginal setæ, of which the inmost is somewhat long (c. 27 μ) and stout. Comb of abdominal tergite 8 complete, fragile, the cilia 8 to 11 μ long. Bristles of abdominal segments 9 and 10 c. 105 and 80 μ in length respectively.

I have known this species for some years and described it two years ago in a long-delayed paper (not yet published) on the British species of the genus *Thrips*. The type is from Box Hill, Surrey.

Hab. FRANCE, in flowers of Marjoram (*Origanum vulgare*), Ax-les-Thermes, August 1926, ♀ ♀ only.

Thrips pillichi, Pr.

Probably of wide distribution.

Hab. FRANCE, Wimereux, common in the flower-heads of *Senecio jacobea* and *Chrysanthemum*, July 1925.

Thrips euphorbiicola, Bagn.

Previously only known from the South of England in flowers of *Euphorbia amygdaloides* and *E. cyparissias*. The ♂ is not yet known.

Hab. FRANCE, Villefranche, in the flowers of *Euphorbia dendroides*, Feb. 1927.

Thrips difficilis, Pr.

Hab. FRANCE, on *Salix repens* growing on the sand-hills near Wimereux, July 1925, ♀ ♀, ♂, and larvæ.

Thrips viminalis, Uz.

FRANCE, Wimereux, July 1925, with above, ♀ ♀ only.

Thrips alni, Uz.

SWITZERLAND, on *Alnus*, ♀ ♀, Sihlwald near Zurich, July 1925.

Superfamily **PHLŒOTHRIPOIDEA**.

Family **Phlœothripidæ**.

Brachythrips terminalis, sp. n.

? ♂.—Length c. 1·15 mm.

Colour brown, head brownish-yellow, legs golden-yellow

with outer margins inclined to yellow-brown; antenna greyish to greyish-yellow, joint 3 basally the lightest; 4 to 6 greyish-brown in the distal two-thirds or thereabouts, 7 and 8 except at base of 7 dark grey-brown. Tube reddish-yellow shading to grey-brown at tip.

Head transverse; cheeks with a rounded swelling behind eyes, then almost straight and subparallel; posterior margin strongly emarginate in the median three-fourths; eyes small, occupying laterally about 0·25 the total length of the head. A strong bristle (21 μ long) near inner margin of the eye anteriorly; a post-ocular pair of about the same length situated about 25 μ behind each eye and a subgenal pair (c. 17 μ long) near cheek at the broadest part, and therefore on a plane intermediate between the posterior margins of the eyes and the postocular bristles. Mouth-cone broad, very broadly rounded and about 0·4 as long as the breadth at base; reaching just over 0·5 the length of the prosternum. Antenna about 2·5 times as long as the head; joint 2 globose, with basal constriction forming a stem and distally truncate; 3 claviform, sides straight so as to be almost obconical with the base more narrow than any of the following joints; 6 the largest of all the joints, subequal in breadth to 5 and but slightly less broad than 2; 7 and 8 broadly and closely united and having the appearance of a single narrow fusiform joint. Relative lengths (and breadths) of the joints 1–8 approximately as follows:—

$$27\ (27) : 43\ (32) : 41\ (24) : 40\ (26) : 46\ (30) : 55{\cdot}5\ (30) \cdot 37\ (18) : 21{\cdot}5\ (12)\ \mu.$$

Pronotum transverse, about 0·56 as long as broad; antero-marginal setæ apparently vestigial, others stout and pointed, the postero-marginal pairs the longest (c. 27 μ) and about 0·2 the median length of the pronotum; the mid-lateral pair (19 μ) 0·7 the length of postero-marginals. Pteronotum strongly transverse, only 0·8 the length of the pronotum and but little more than 0·4 as long as broad. Legs normally stout, fore-pair somewhat swollen and the fore-tarsus armed with a small sharp tooth.

Abdomen heavy with segments strongly transverse, 8 and 9 broadly rounded to tube, which is 0·7 the length of the head; abdominal bristles short, rather stout, lightly coloured and pointed; terminal hairs colourless, difficult to distinguish, but apparently only about 0·35 the length of the tube.

Length (and breadth) of head, pronotum, and pteronotum 137 (170), 140 (250), and 108 (283) μ respectively; breadth

of abdomen c. 365 μ; length of tube and breadth at base and at apex, 90, 60, and 21·5 μ respectively.

Hab. FRANCE, Tamaris, March 1st, 1927, 1 example (almost certainly ♂), whilst beating *Erica arborea*.

Trichothrips propinquus, Bagn.

Hab. FRANCE, Fontainebleu, 1 ♀ from under a *Corticium* growing on oak, August 1926.

Cryptothrips brachyurus, sp. n.

♀.—*Forma aptera.* Length about 2·4 mm.

Dark blackish-brown; fore-tibiæ and tarsi lighter brown. Antenna concolorous with the head, joint 3 yellow-brown to brown, base paler, 4 dark brown but not so dark as the following. Head about 1·3 times as long as broad, eyes small occupying about 0·22 the total length of the head; cheeks slightly arcuate and widest near middle, minutely and sparsely spinulose; post-ocular bristles fine, as long as, or slightly longer than, the eye.

Pronotum scarcely little more than 0·5 the length of the head and more than twice as broad as long; median longitudinal depression distinct; postero-angular bristles colourless, 0·6 (c. 90 μ) as long as the median length of pronotum. Seta on fore-trochanter short (c. 27 μ). Legs somewhat long, fore-tarsus unarmed.

Abdomen elongated, segments 8 and 9 roundly narrowed to tube, which is scarcely more than 0·6 the length of the head and very stout. All bristles pale and very slender and hair-like, the longest on segments 7, 8, 9 being 175, 108, and 230 μ respectively; terminal hairs apparently not quite as long as the tube (? c. 162 μ).

Length of head and breadth across eyes and near middle 300, 222, and 236 μ respectively; length of eye 67 μ; length (and breadth) of pronotum and pteronotum 162 (350) and 300 (470) μ respectively; width of abdomen at segment 5, 554 μ; length of tube and width at base and at apex, 190, 100, and 40 μ respectively.

♂.—Length c. 1·9 mm.

Smaller; fore-legs enlarged and fore-tarsus armed with a long strong tooth; fore-tibia armed with a short long-seated sharply defined tooth at apex within, similar to teeth at apices of fore-femora within in the genus *Hoplandrothrips*.

Hab. FRANCE, Eze, 1 ♀, Villefranche, 1 ♂, on *Brachypodium ramosum*, Feb. 1927: Tamaris, 1 ♀, 2 ♀ ♀ on a grass, March 1st, 1927.

Readily distinguished by the short stout tube and the very fine bristles, the latter reminiscent of *C. tenuipilosus*, Bagn., another Mediterranean species.

Liothrips amabilis, sp. n.

♀.—Length about 2·0 mm. Near *L. pragensis*, Uz.

Colour black, antenna clear yellow with joints 1, 2, and 7 of a deeper shade (1 inclined to a light greyish yellow-brown) and 8 light grey-brown; all femora greyish-brown to brown, dark along the anterior margins, all tibia deep golden-yellow, tarsi paler. Fore-wings stongly fumate in the basal three-fifths (0·6) or thereabouts, darkest at base and paler in the distal two-fifths (0·4). All bristles strong, straight, dark, and blunt.

Head much as in *L. pragensis*, only about 1·25 times as long as broad, apparently swollen dorso-ventrally and with the gently rounded sides converging posteriorly; raised vertex covering the basal part of the first joint of each antenna and having the overhanging anterior ocellus at apex. Eyes occupying a little less than 0·25 the dorsal length of the head; postocular bristles present much as in *pragensis*.

Antenna about 1·8 times as long as the head, much as in *pragensis* with the relative lengths of joints 3–8 approximately as follows:—

98 (31) : 86 (41) : 78 (35) : 70 (34) : 57 (28) : 33 (16·5).

Pronotum short, only 0·4 the length of the head, strongly transverse, being about 2 8 times as broad as long; bristles of anterior margin weakest, the mid-laterals longer, and those at posterior angles longest of all, being about 0·8 the median length of the pronotum. Pteronotum quadrate; wings broad, sub-basal bristles of fore-wing disposed in a practically straight line, 2 being on a very slightly lower plane than 1 and 3, and practically sub-equal, 3 being c. 75 μ in length and but slightly longer than 1 and 2; cilia close with a duplicated series of 15.

Abdomen broad, ovate, bristles long, stout, straight, dark, and blunt; terminal hairs slender, light-coloured, and about as long as the tube, which is about 0·7 the length of the head.

Length (and breadth across eyes) of head 284 (230); length (and breadth) of pronotum 114 (324), pteronotum 365 (418), and fore-wing 945 (101) μ. Breadth of abdomen 526 μ; length, breadth at base, and at apex of tube 202, 89, and 45 μ respectively.

Readily distinguished from *pragensis* by the broader swollen head, the pale 1st antennal joint, the strongly fumate fore-wings, the brown femora, and more deeply shaded tibiæ, etc.

Hab. FRANCE, near Hyères-la-Plage whilst beating *Phyllirea*, Feb. 1927, 1 ♀ only.

LXV.—*A new Agromyzid Fly of Economic Importance from Africa.* By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

IN 1921 I published a paper in which I divided the genus *Leucopis*, Meigen, into three subgenera *.

At the time this work was done I did not have available the genotype of *Leucopis*, and erred in assigning the subgeneric name *Leucopomyia* to the segregate with a pair of strong prescutellar acrostichal bristles and no ocellars, as this combination of characters is possessed by the genotype of *Leucopis*. Consequently the name *Leucopomyia* is a synonym of *Leucopis*, and the subgenus to which I assigned the latter name must be renamed. I avail myself of the opportunity for doing so in the present paper and at the same time present the description of a new species for which I erect an additional subgenus.

The species of all the subgenera so far as they are known are predaceous on Aphididæ and Coccidæ, and are of economic importance.

Key to the Subgenera.

1. Thorax without a pair of distinguishable prescutellar acrostichal bristles; ocellar and mesopleural bristles lacking......	[(genotype, *bella*, Loew). *Leucopina*, subgen. nov.
Thorax with a pair of well-developed prescutellar acrostichal bristles	2.
2. A distinct pair of backwardly curved ocellar bristles present; mesopleura without bristles on hind margin	*Neoleucopis*, Malloch.
No ocellar bristles distinguishable	3.

* Bull. 111, State Natural History Survey, xiii. art. 14.

3. Mesopleura without a bristle on hind margin near middle	*Leucopis*, Meigen.
Mesopleura with at least one distinct bristle on hind margin near middle ..	*Leucopella*, subgen. nov.

Subgenus LEUCOPELLA, nov.

Similar to *Leucopis*, Meigen, in all characters, except in having at least one small but distinct bristle on hind margin of mesopleura near middle.

Subgenotype, the following species.

Leucopis (*Leucopella*) *africana*, sp. n.

Male.—Black covered with the usual grey dust as in other species. Frons, when seen from above and in front, dark grey on central stripe; basal two antennal segments testaceous, with grey dust, third segment and arista black; palpi yellow. Thorax with two rather broad dark brown vittæ over the region of dorso-centrals, which are not sharply outlined outwardly and become diffuse behind, merging with the paler brownish suffusion of posterior part of mesonotum, the lateral areas also more brownish than the area between the vittæ, the usual two grey submedian slender vittæ faint, and distinguishable only on anterior margin from certain angles; disc of scutellum brownish. Abdomen with most of dorsal part of first visible tergite and two large diffused patches on second tergite brownish fuscous, the third and fourth tergites with a faint dark central vitta. Legs testaceous yellow, fore coxæ and all femora largely fuscous, grey-dusted. Wings hyaline. Calyptræ white. Halteres pale yellow.

Inner vertical bristles much shorter than outer pair; frons widened in front; third antennal segment not as long as high; cheek about as high as third antennal segment, the genal bristle not very conspicuous. Prescutellar acrostichals rather short and weak; basal pair of scutellar bristles much shorter than apical pair; usually a setula close to the mesopleural bristle. Fore femur in male with short black setulose hairs on most of the length of antero-ventral surface. Veins 3 and 4 convergent apically.

Length 2 mm.

Type and two paratypes, Doondu, Kenya Colony, Africa, 25. viii. 1925, predaceous on *Pseudococcus citri* on coffee (*T. W. Kirkpatrick*).

Along with the specimens is one puparium, 2 mm. in length and 0·75 in diameter, which is slightly tapered anteriorly, and has the posterior spiracles situated upon two

elevated stalks, which are separated by more than the length of either, tapered apically, and at least twice as long as their basal diameter.

I have seen some specimens reared from the same host in Italy, but they do not belong to the same subgenus; they are in the United States National Museum.

LXVI.—*Some Indian* Chloropidæ (*Diptera*) *of Economic Importance*. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

IN this paper I present descriptions of three new species of this family, all belonging to known genera, and record the rearings of four other species, the habits of which were previously unknown. Two of the species were sent to me by Dr. G. A. K. Marshall, the others were sent by Rao Sahib Y. Ramachandra Rao, for identification. The types will be deposited in the British Museum.

It must be borne in mind that, though the specimens were reared from larvæ in mines in the various plants mentioned in the text, there is lacking definite evidence showing that they caused the mines, and further investigation is necessary to prove whether they are the primary or secondary cause of the damage to the plants.

Lagarocerus tenuicornis, sp. n.

Female.—Head testaceous yellow; frontal triangle except the sides on anterior half glossy black; occiput black on upper half except at lateral angles of vertex; antennæ black, second segment mostly rufous, third rufous on basal third on underside; arista white, yellow at base; palpi black. Thorax black, dorsum grey-dusted and with six shining black vittæ, the lateral margins yellowish; pleural sutures and the propleura yellowish; scutellum black on disc, the margin testaceous. Abdomen black, shining. Legs testaceous, sometimes with the femora more or less discoloured. Wings hyaline, veins dark. Halteres brownish.

Vertical and ocellar bristles distinct but short, the post-vertical pair shortest; triangle extending to anterior margin of frons, rather abruptly narrowed on anterior half; third antennal segment fully three times as long as second, tapered apically; arista densely pubescent. Thorax and scutellum with many piliferous punctures, the black

vittæ on former slightly raised; notopleurals 1+2; a bristle on hind margin of mesonotum in line with each anterior lateral angle of scutellum; scutellum with two moderately long and two very short marginal bristles. Dorsum of abdomen alutaceous. Hind tibia without a sensory area. Fourth vein subobsolete apically; second costal division three times as long as third.

Length 2–2·5 mm.

Type and two paratypes, reared from larvæ boring in shoots of *Chloris barbata*, Coimbatore, S. India, 3 & 7. iv. 1922 (*Y. Ramachandra Rao*).

This is evidently the species recorded from the same locality by Lamb under the specific name *longicorne*, Thomson.

Mounted with two of the specimens are the puparia from which they emerged. These are 3·25 mm. in length, of a terracotta colour, and slightly shining, with the surface microscopically transversely striate, the anterior extremity slightly flattened dorso-ventrally, and the posterior extremity rounded. The anterior spiracles are fan-like and have twelve pale radiating papillæ; the posterior spiracular discs are not well defined, though the slits are elevated so that they form slight humps on the surface, these being distant from each other more than the diameter of either. The central slit of each set is horizontally placed, and the upper and lower slits are directed obliquely upward and outward and downward and outward respectively, while there is a fourth and smaller elevation which apparently represents what is usually referred to as the "button." I can detect no fine filaments in the specimens, though no doubt these are present in the larval stages.

Chalcidomyia atricornis, sp. n.

Glossy black. Frons metallic blackish blue; fac spicuously yellow below antennal insertions, and yellow transverse band on lower margin; antennæ an black. Thorax with a quite conspicuous yellow m upper margin of mesopleura. Abdomen with a bluis Legs yellow, coxæ, trochanters, and femora, except apices, black, hind tibia before middle, and apical seg of all tarsi brown. Wings hyaline, with a black mar base filling costal and subcostal cells and extending to b cells, but not to inner cross-vein, and usually with a q conspicuous dark spot between apex of third vein costa. Stem of halteres fuscous, knob lemon-yellow.

Frons entirely smooth; antennæ extending a little below lowest part of face, third segment fully three times as long as wide. Thoracic dorsum and scutellum with numerous piliferous punctures, the scutellum with a pair of apical bristles. Abdomen smooth and impunctate. Hind femora slightly thickened. Wings as in *polita*, de Meijere.

Length 2–2·5 mm.

Type and two paratypes, reared from larvæ boring in ginger plant, 17 & 21. ix. 1926 (*Y. Ramachandra Rao*).

This species is very similar to *punctifera*, de Meijere, to which it runs in that author's key to the species of the genus, but *punctifera* has the antennæ quite conspicuously reddish in part and the mesopleural yellow mark is faint or lacking.

Lamb has recorded *polita*, de Meijere, from Malabar, with the note: "In ginger-stem attacked by *Dichocrocis*."

Formosina flavipes, sp. n.

Male.—Head shining yellow; face with whitish bloom; a black spot over ocelli and a larger one on anterior part of the glossy frontal triangle, which are probably connected in some specimens; occiput black on sides of upper half, a line of the dark colour running over vertex at each hind angle of frons; upper surface of second antennal segment brown, apex and upper margin of third segment fuscous; palpi black. Thorax yellow, the usual five black dorsal vittæ fused, the central one extending to anterior margin, the submedian pair extending to midway between suture and anterior margin, the sublateral pair extending to suture, the central one and submedian pair attaining posterior margin; scutellum yellow; pleura glossy yellow, with a diagonal black mark on lower margin of mesopleura, a large black triangle on sterno-pleura, and most of pteropleura and hypopleura black; metanotum black, not polished, pilose. Abdomen yellow, hind margin of third visible tergite broadly black, except in middle, where it is more narrowly so, fourth tergite black, with a narrow pale hind margin, fifth blackened along posterior margin; hypopygium black on posterior half. Legs honey-yellow. Wings hyaline, veins brown. Knobs of halteres whitish yellow.

Frons over 1·5 as long as wide, slightly widened anteriorly, the triangle broad, extending to anterior margin; neither vertical nor ocellar bristles developed, the frons almost bare; third antennal segment rounded at apex, not 1·5 as long as wide; arista almost bare; palpi slightly

widened. Thoracic dorsum with piliferous punctures, except on the outer part of the glossy lateral yellow areas ; anterior notopleural bristle yellow, the posterior pair black ; scutellum flattened above, with subangular margin, the discal hairs yellow, marginal setulæ (10–12) black. Abdomen stout, tapered apically, hypopygium slightly pendulous. Legs normal. First and costal veins very noticeably thickened, the latter at apex of first vein wider than marginal cell at that point ; last section of third vein thin, not bent forward, a little less than three times as long as preceding section.

Length 5–6 mm.

Type and two paratypes, reared from larvæ boring in ginger-plant, 16, 18, & 19. ix. 1926 (*Y. Ramachandra Rao*).

Mounted with the type-specimen there is a reddish puparium, which is 9 mm. in length and 2 mm. in width. It is slightly flattened dorso-ventrally at anterior extremity and rounded at posterior extremity. There are microscopic spinules at most of the joints, the large anterior spiracles are reniform, and each has about 30 minute pale palpiliæ, which extend round the edge, except for a short space in middle on hind side ; the posterior spiracular discs are black and distinctly elevated, mound-like, they are separated by a distance equal to less than the diameter of either, the three slits are linear, straight, and much as in typical Anthomyiid larvæ, the upper and lower being directed vertically, and the side one directed straight outward ; the filaments that protect the spiracular slits are very evident in the specimen, being quite numerous and yellow in colour, thus showing up against the black-coloured disc.

The species in the adult stage is most like *ochracea*, Becker, but the latter has the frons entirely yellow, and only the fourth abdominal tergite black. The almost straight apical section of fourth vein and much swollen first and costal veins are quite distinctive.

Pseudurina maculata, de Meijere.

Some time ago Mr. Y. Ramachandra Rao sent to me four specimens of this species, which were reared from larvæ found boring in shoots of *Imperuta arundinacea*, at Samalkote, S. India. Mounted with the specimens are the empty puparia. These latter are of the same general shape as that of the preceding species, but they are more shining and the entire surface is transversely ridged, there being about fourteen ridges to each segment, the ridges being more

prominent at posterior extremity. The anterior spiracles project fan-like, and each has about ten minute pale papillæ; the posterior spiracular discs are black, the space between them is not half as great as the width of either, the outer margin is elevated rim-like, and the centre is depressed, with the three slits raised and broader than in last species, and the filaments, while quite evident, not so conspicuous as in that species.

There is no published record of the larval habits of this species.

Eurina albovariegata, Thomson.

I have before me a specimen of this species reared from a larva in *Paspalum scrobiculatum* at Avadi, Madras, 16. xii. 1921 (*Menon*).

Lamb has described *E. oculata* from Madras, and recorded it as "feeding on leaf-parenchyma of grass."

Anatrichius erinaceus, Loew.

One specimen of this widely distributed species from Samalkote, S. India, is labelled "From *Panicum stagninum*," 13. xii. 1921 (*Y. Ramachandra Rao*).

Microneurum funicola, de Meijere.

A specimen of this species labelled "Cowpea stems," xi. 1909, Koilpati (*Y. Ramachandra Rao*).

LXVII.—*Notes on the West African Lizard* Mabuya perrotetii. By H. W. Parker, B.A.

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Among a collection of reptiles and batrachians collected at Cape St. Mary, Gambia, by Mr. T. R. Hayes, and presented to the British Museum by H.E. Sir C. H. Armitage, C.M.G., D.S.O., are ten adults of the skink *Mabuya perrotetii* (Dum. & Bibr.) and a series of late embryonic and early hatchling stages. The adults show a marked sexual difference in coloration, and the eggs and young do not appear to have been previously described.

The normal colouring of the adult female has been carefully described by Lorenz Müller *. The adult male, however, has the flanks as light as, or frequently lighter than, the mid-dorsal area and suffused with pale salmon-pink; the white lateral flecks are common to both sexes. This

* L. Müller, Abh. Ak. Wiss. München, xxiv. 1910, p. 574.

lightening of the colour of the flanks in the male renders the dorso-lateral light stripe, which is usually so conspicuous in the female, rather indistinct. The livery of the very young is similar to the normal colour of the female, but the dorsum is paler (pale bronze) and the lateral band darker, more sharply defined, and without distinct white flecks.

The eggs, twenty-two in number, were found buried 3 inches deep in sand under dead grass on September 20th, 1926, towards the end of the rainy season. They were kept by Mr. Hayes under warm, moist conditions, pairs of eggs and, later, young lizards being preserved at intervals. The eggs are of the usual soft-shelled type found in other oviparous skinks, and measure 15 mm. × 9 mm.; their size is constant in the present series. In the following list the external characters and dimensions (in millimetres) of the embryos and young are noted :—

1. *September 20th; fourth week before hatching.*

One fœtus: length 37; tail 20; fore limb 6; hind limb 8; head (measured from tip of snout to anterior border of ear) 6·4. Much yolk unabsorbed. Fœtus quite unpigmented; tympanum superficial; no egg-tooth.

2. *October 1st; third week before hatching.*

One fœtus: length 47; tail 26; fore limb 7; hind limb 10; head 6·5. Much yolk still unabsorbed. Pigment slightly developed on flanks; tympanum superficial; no egg-tooth.

3. *October 7th; second week before hatching.*

One fœtus: length 54; tail 29; fore limb 8; hind limb 11; head 7·5. Yolk-sac almost empty. Juvenile colouring fully developed; tympanum sunk; egg-tooth developed.

4. *October 14th; first week before hatching.*

One fœtus: length 61; tail 36; fore limb 8·5; hind limb 11; head 7·5. All characters as in 3.

5. *October 23rd; first week after hatching.*

Three specimens; average measurements: length 63·5; tail 36·5; fore limb 8·2; hind limb 11; head 7·4. Egg-tooth still present; umbilicus visible.

6. *October 30th; second week after hatching.*

Four specimens; average measurements: length 63·5; tail 36·5; fore limb 8·25; hind limb 11·2; head 7·4. Egg-tooth lost; umbilicus visible.

7. *November 8th; third week after hatching.*

Six specimens, all moribund or dead; average measurements: length 63; tail 36; fore limb 8·1; hind limb 11; head 7. As in 6.

From these details the following conclusions may be drawn:—Growth of the fœtus occurs at a fairly constant rate (about 1 mm. in total length daily) during the later stages of development up to the time of hatching; pigment commences to be deposited during the fourth and third weeks before hatching, and the egg-tooth is developed during the third and second; the latter is lost during the first week of free existence, but the umbilicus is still visible after three weeks. The figures indicate that no growth or change occurs during the first three weeks after leaving the egg, but, as all the specimens were either dead or dying at the end of that time, it seems probable that they were obtaining unsuitable or insufficient food, and consequently no conclusions can be drawn from their dimensions.

As may be seen from the following table, appreciable changes in proportion occur during and after the period of development previously considered; the figures given are the average ratio of the length of the tail, fore limb, hind limb, and head to the distance between snout and vent for the specimens mentioned in the first column:—

Specimens.	Tail.	Fore limb.	Hind limb.	Head.
7 ♂♂, Gambia	1·6*	·27	·37	·20
8 ♀♀, Gambia	....	·27	·37	·19
6 juv. in third week	1·33	·30	·40	·26
4 juv. in second week	1·35	·30	·40	·27
3 juv. in first week	1·35	·30	·41	·27
1 fœtus first week before hatching.	1·4	·34	·44	·30
1 fœtus second week before hatching.	1·2	·32	·46	·30
1 fœtus third week before hatching.	1·2	·33	·48	·31
1 fœtus fourth week before hatching.	1·2	·35	·47	·37

* Only one specimen included in this figure; all others with regenerated tails.

Although these figures are unsatisfactory in being derived only from single specimens in the earlier stages, there appears to be a distinct reduction in the proportionate size of head and limbs and increase in the length of the tail from a late fœtal stage to the adult condition. The larger head and shorter tail of the young are probably normal conditions, and are found in other families—*e. g.*, Agamidæ * and Lacertidæ †, —but the longer limbs of the late fœtus may have a phylogenetic significance. Without comparative figures for other species no definite conclusions can be drawn, but the fact that the limbs attain their maximum development a considerable time before the end of the fœtal period, and are in process of reduction at the time of hatching, precludes any probability of the longer limbs of the young being adaptive. It appears much more probable that they are an inheritance from the longer-legged ancestor from which *Mabuya perrotetii* has been derived.

LXVIII.—*On a new Species of the Nematode Genus* Aprocta.

By E. A. Spaul, Ph.D., B.Sc., Birkbeck College (University of London).

The species described and figured below was found in a collection sent for identification to Dr. H. A. Baylis, of the British Museum (Natural History), by M. R. Ph. Dollfus. It was obtained from a Little Owl (*Athene noctua*) near Rabat, Morocco.

Aprocta noctuæ, sp. n.

The material consisted of three adult females and one adult male. The measurements of the females were in close agreement, and the averages are tabulated with the dimensions of the male.

The cuticle is thin, smooth, and non-striated; the body cylindrical and of uniform thickness, tapering slightly in the œsophageal region, whilst posteriorly there is a slight increase in the width ; both ends are bluntly rounded ; the subcuticular and muscular layers are clearly seen, especially anteriorly to the vulva and beyond the posterior extension of the generative organs. There are no definite lip-like structures, but the mouth is apparently surrounded by the usual papillæ (two lateral and four submedian). There is a

* Annandale, Spol. Zeyl. 1918, viii. p. 135.
† Boulenger, Mon. Lacertidæ, i. p. 33 (1920).

small buccal cavity leading to the œsophagus, which is transversely striated throughout, with no posterior enlargement or other modification. The terminal portion of the intestine is a short narrow canal, ending in a minute and possibly non-functional anus. No caudal papillæ were observed in the male. A small pore, with what appears to

Fig. 1.

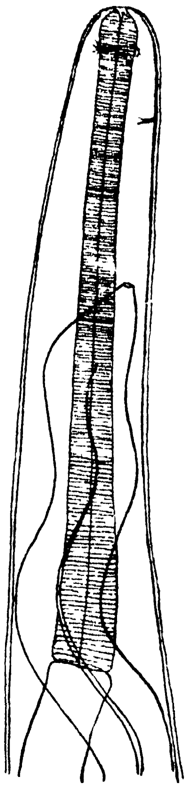


Fig. 2.

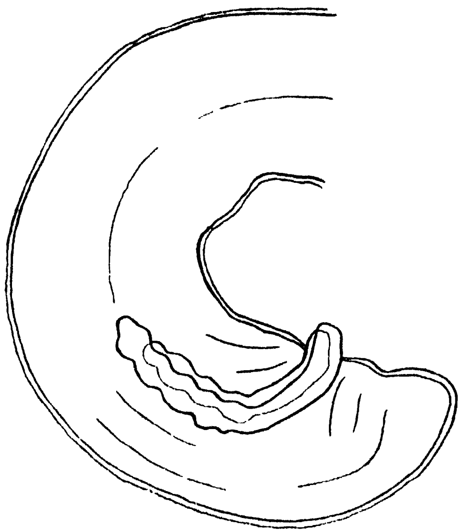


Fig. 1.—Anterior end of female showing œsophagus, vulva, vagina, uteri, and vestigial excretory pore.
Fig. 2.—Posterior end of male, showing recurved end and spicules.

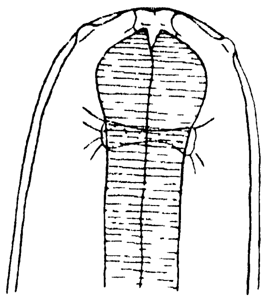
be a duct leading into it, and corresponding probably to the excretory pore, was observed near the anterior end. In other species of the genus an excretory pore is frequently said to be absent, but it may be merely difficult to locate. The nerve-ring does not seem to be well developed, being indistinct and difficult to detect.

In the female the vulva opens in the œsophageal region, the short vagina passing back to give origin to two uterine branches. The ovaries and oviducts are posterior, surrounding the intestine, and take up the greater part of the body-cavity, being distended with thick-shelled eggs in various stages of development, those in the uteri containing fully-formed embryos.

The male is similar to the female, except in size and the reproductive organs. The tail is bluntly rounded and recurved. The spicules are curved, unequal; the distal ends are blunt, and the proximal ends have a series of uneven swellings resembling a string of nodules, and serving possibly for muscle-attachments.

Apart from dimensions, these specimens have other distinctive features which necessitate the erection of a new

Fig. 3.



Head of female.

species of the genus *Aprocta*. Skrjabin (1917) divided this genus into two groups depending on the absence or otherwise of an anus in the female so as to include *A. microanalis* (Skrjabin, 1917), the first and only member so far recorded possessing a vestigial anus. A description of the female only is given, the male being unknown, but the ratio of the length of the œsophagus to the total length (1/24th), and the tail (anus to end) to length (1/240th), the size of the eggs ($50\,\mu \times 34\,\mu$), and the cuticular striations are characters sufficiently marked and different from those of the species described here to show that it is not identical.

Of those members described as being without an anus and placed in the first group, *A. ærophila* (Linst., 1906) and *A. cylindrica* (Linst., 1883) have postanal papillæ, the former two pairs and the latter one, *A. rotundata* (Linst., 1903) no

postanal papillæ but an unpaired preanal papilla, *A. narium* (Linst., 1901) caudal papillæ and two distinct regions in the œsophagus, *A. turgida* (Stoss., 1902) no lips or cephalic papillæ, equal spicules, and longitudinal striations, *A. crassa* (Railliet & Henry, 1910) and *A. matronensis* (Railliet & Henry, 1910) have lips, *A. ophthalmophaga* (Stoss., 1902) no lips, equal spicules, *A. orbitalis* (Linst., 1901) transverse striations and transverse rows of chitinous scales near the cloaca in male. Apart from these distinctive features and others, all, together with *A. anthicola* (Linst., 1903) (male unknown), show dimensional differences from *A. noctuæ* (sp. n.) and variations in the size of eggs, spicules, position

Fig. 4.

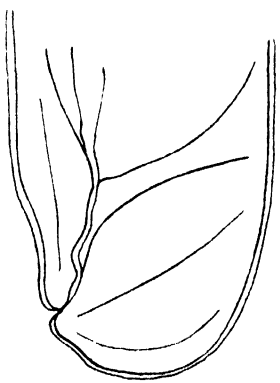


Fig. 5.

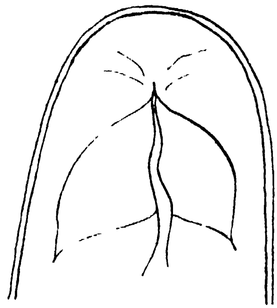


Fig. 4.—Side-view of posterior end of female, showing anus and terminal portion of intestine.

Fig. 5.—Ventral view of posterior end of female, showing anus and terminal portion of intestine.

of the vulva, and ratio of lengths of œsophagus and tail to total length.

The presence of a degenerate excretory pore, reduced intestine, and vestigial anus suggest that this species is possibly one of the least specialised members of the genus yet described, and hence probably one of the more primitive types.

The work was carried out at Birkbeck College, University of London, and my thanks are due to Dr. H. A. Baylis for his courtesy in enabling me to examine the material. The type-specimens are deposited in the British Museum (Natural History).

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Table of Measurements of Aprocta noctuæ, *sp. n.*

	♀.	♂.
	mm.	mm.
Length	38	15
Width (max.)	·72	·46
Length of œsophagus	1·3	·9
Width of œsophagus	·09	·08
Nerve-ring from anterior end	·12	·145
Excretory pore from anterior end	·32	·23
Vulva from anterior end	·72	..
Eggs	66 μ × 38 μ	..
Spicules	..	(*a*) ·304 (*b*) ·217
Tail	·075	·075
Width at head-end	·16	·1
„ anus	·3	·13
„ vulva	·36	.
Œsophagus/length	1/29	1/16·6
Tail/length	1/506	1/200
Anterior end to vulva/length	1/53	..

LXIX.—*A new Species of* Phlœothrips *from France.* By OSCAR JOHN.

Phlœothrips (subgen. *Hoplandrothrips*) *priesneri*, sp. n.

General colour blackish brown; first two antennal joints of body-colour; third yellowish tinged with brown in its distal half; fourth to sixth brown, at base broader, at tip narrower yellowish; seventh yellowish at extreme base; eighth dark brown. Femora blackish brown, all tibiæ and tarsi light yellow. Fore wings with a yellowish tinge. Setæ on body light.

Head elongate, by 0·26 longer than wide, widest behind the eyes and narrowed before base. Antennæ by 0·8 longer than head. Postocular bristles long, about the length of diameter of the eyes, knobbed; sides of head with minute warts bearing each a strong bristle. Eyes about one-third the length of the head.

Prothorax short, somewhat over twice as broad as long; fore angles and sides with one, hind angles with two knobbed setæ, of which those on the fore angles are longest. Pterothorax somewhat wider than prothorax.

Fore wings parallel-sided with 9 resp. 8 interpolated ciliæ.

Fore femora strongly incrassate with two small teeth at end; fore tibiæ with a small prominence or tubercle near base; fore tarsi armed with a strong tooth.

Abdominal segments with long knobbed lateral setæ. Ninth segment with very long knobbed dorsal and pointed lateral and ventral setæ. Tenth segment (tube) by 0·27 shorter than head, somewhat less than twice as wide at base as at apex.

Measurements in μ.—Length of head 217; width of head 170 behind the eyes and 166 at base. Length of prothorax 132, width 288. Length of tube 163, width at base 70, at tip 33. Total length 1·68 mm.

Antennal joints	1	2	3	4	5	6	7	8
Length	26	56	56	67	56	52	48	37 = 0·4 mm.
Width........	30	30	37	37	30	22	20	12

This species, which comes nearest to *Phl. bidens*, Bagn., and especially its variety *tridens*, Priesn., belongs to the subgenus *Hoplandrothrips*, and differs from all European species of the genus by the light unshaded tibiæ.

Described from one male specimen taken near Villefranche in the Rhône Department of France on the 11th November, 1926, from turf.

I take advantage of dedicating this new species to the eminent thysanopterologist, Prof. Dr. Hermann Priesner, of Linz, Austria.

LXX.—Varanus komodoensis, *Ouwens*. By Dr. J. K. de Jong, Zoological Laboratory, University, Amsterdam.

In 1912 Mr. Ouwens (Bull. Jard. bot. Buitenzorg, (2) vi. p. 1) described a new species of *Varanus* from the island of Komodo. This new species was said to attain for lizards the extraordinary length of 6–7 metres, but the largest specimen of which there is a definite record is that shot by Sergeant Beker, measuring about 4 metres. Our knowledge of this interesting species, however, was only very scanty; besides the description of Mr. Ouwens some hides reached Europe, but of the skeleton and the inner organs we did not

possess any information. It was therefore a happy event that, in the end of 1926, a living specimen reached the Amsterdam Zoological Garden. Unfortunately, this specimen, which afterwards proved to be a male, was in a rather bad condition, and it died on December 3. Thanks to the kindness of the Director of the Zoological Garden, Dr. C. Kerbert, and of the Director of the Zoological Museum, Dr. L. F. de Beaufort, I was able to study the animal in detail.

Ouwens already gave a description of the external morphological characters, but this description is rather short and we do not find every information we should like to possess. Miss Dr. Nelly de Rooy (Rept. Indo-Austr. Arch. i. 1915, p. 150) was able to give a more detailed description, thanks to the presence of a skin and a skull in the Leyden Museum, but some details of the outer form remained still doubtful (*l. c.* p. 151). I will therefore give in this place a full description of the external morphological characters, and it is my intention to publish in some "Anatomical Notes" the internal organisation and a description of the skeleton *.

The snout is rounded, very broad, and depressed. Its length equals the distance from the ear to the anterior corner of the eye, or the distance from this point to the tip of the snout. The canthus rostralis is rounded. The nostril is large, oval, and horizontal. Its depth is contained once and a half in its length. It is surrounded by eleven shields. The distance from the nostril to the tip of the snout is one-third of its distance to the orbit. The teeth are sharp and compressed, the anterior edge is a little serrated. The head-scales are large and roundish, those on the snout are largest and a little elongate, the temporal ones are smallest. The nasals are separated by eight shields, the supraorbital regions by four shields, which are smaller than the shields on the snout and on the occiput, but larger than the temporal ones. The ear-opening is vertically oval or nearly slit-shaped, the tympanum is attached to the anterior border of the ear-opening, almost at the same level of the upper surface of the body. Its posterior border lies very deep, so that the tympanum forms an angle of nearly 90° with the skin of the temporal region. The neck is long, once and a half the distance from the tip of the snout to the posterior border of the parietal bone. The nuchal

* de Jong, J. K., und Brongersma, L. D., "Anatomische Notizen über *Varanus komodoensis*.—I. Die Bewegungen im Schädel von *V. komodoensis*," Zool. Anz. lxx. 1927, pp. 65–69.

scales are large and conical, almost as large as those on the snout, separated from each other by small granules. The back is covered with somewhat smaller scales, which are arranged in more or less distinct transverse series. They are strongly keeled. The ventral scales are smooth or indistinctly keeled in 85 (80–97) transverse series. The scales of one transverse row are juxtaposed, but those of two following series are separated from each other by a row of small granules. On the posterior part of the tail these granules are absent. Behind the mental and between the lower labials we find a rather deep groove in which the skin lies with many folds, which folds disappear partly when the lower jaws separate from each other by means of the indistinct joint between the dentary and supra-angular bones. Three distinct folds of the skin on each side of the neck beginning on the throat and diverging to the shoulders. A small but distinct fold between axilla and groin.

The tail is longer than the body and covered with keeled scales, the lower scales are largest. The tip of the tail has broken off, and, comparing it with the tail of other *Varanus* species, at least 50 cm. is missing. The number of transverse series of the ventral scales is 165, but Ouwens gives a number of 218, which will be nearer to the truth. The tail is compressed only in its posterior half, in the anterior half its transverse section is triangular. At its base the height of the tail is 135 mm. and its breadth 120 mm. There is a low but distinct crest on the posterior three-fourths. This crest consists of two vertical erect scales with on each side one smaller erect scale. Along the base of the tail is an indistinct crest on each side, which consists of two or three rows of scales. The base of the tail is rounded.

Limbs strong and short, digits strong, compressed, with very strong claws.

The colour above is dark greyish brown, lower parts lighter. The tongue is yellow and not, as Ouwens writes, long, but rather short, comparatively shorter than in other *Varanus* species.

Measurements.—Length of head and body 130 cm., tail 120 cm. without the lost tip. Distance from the tip of the snout to the fore limb 50 cm., distance from axilla to groin 53 cm. Length of the fore limb 40 cm., of hind limb 45 cm. (thigh 15 cm.). Weight after death 42 kg.

It is not necessary to give figures, as the illustrations given by Mr. Ouwens, chiefly the figure of the head, do not need any improvement.

BIBLIOGRAPHICAL NOTICE.

The Migration of Birds. By ALEXANDER WETMORE. Published and printed at the Cambridge Harvard University Press, 1926, and published in this country by Humphrey Milford, Oxford University Press. Pp. 217 and woodcuts. Price 10*s.*

IN a very small volume Mr. Wetmore has succeeded in giving us a very great mass of information in regard to the migration of birds, whether we consider the subject from the point of view of facts or of theories only. Mr. Wetmore commences with an historical account of migration, in which he traces back a knowledge of migratory movements in birds to the Old Testament, and from thence forward to the present day. He then discusses the theories concerning the causes of migration, which, roughly, he may be said to summarize as (1) Failure of food in one area forcing movement to another; (2) Changes in temperature; (3) Individual competition in the struggle for existence; and (4) The theory of Phototropism, *i. e.*, the demand for light or the following of the sun. He also refers briefly to a theory that migration is merely an indulgment in the pleasure of flight. Mr. Wetmore himself appears to favour the third theory, although he may not go as far in support of it as some others do. Having discussed theories, Mr. Wetmore then proceeds to place before us the material upon which he and others have based their opinions and, perhaps, a paragraph of his preface explains what he himself thinks about migration, for he says:—"After careful consideration of the subject the writer is profoundly impressed by the mass of detail regarding the movements of birds that has been assembled and the little that has been definitely ascertained regarding the underlying principles that control migration. There is much that remains to be established on this phase of the subject." This is probably the conclusion to which the author's readers will arrive. They will, however, have ready to their hands practically all the information available compressed into a very small space and dealt with in a most practical and systematic manner, so that they will be able to start with a knowledge of the subject which must have taken the author many years to compile. This work should form a basis for further useful research, and should prove a stimulus to those whose interests are already absorbed in such investigations.

We congratulate Mr. Wetmore on having been able to give us so much information in so readable a form, but we may regret, perhaps, that it does not deal quite so extensively with migration outside the two Americas as it does with the migration within.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 114. JUNE 1927.

LXXI.—*Abnormal Forms of* Gonium. By W. B. Crow,
M.Sc., Ph.D., F.R.M.S., University of Wales, University College, Cardiff.

In former publications (3, 4) the writer has described abnormal forms of *Pandorina* and *Eudorina*, showing sterile cells, observed by himself and other writers, and drawn attention to their phylogenetic significance. Definite somatic variants of a similar kind have now been seen in *Gonium pectorale*, Müll., and will be described here, together with some other abnormal forms that were met with at the same time. The significance of these forms will then be discussed.

Material.

The material investigated consisted of a culture of *Gonium pectorale* made up from material collected by Prof. R. C. McLean from a small rain-tub near Port Eynon, Gower, in September 1926. On arrival the colonies were of the normal type, and were actively dividing. None of the abnormal forms seen later were noticed in the original material, although a few four-celled colonies may have occurred. The dense green suspension of colonies was diluted with water. Approximately one-third of the total volume of standard Knop's solution was then added. In this solution the colonies were kept in a state of active division for about two

weeks, after which they died. The solution in the culture obtained in this way was allowed to evaporate to about one-quarter of its bulk. During this process the colonies were observed and abnormal forms discovered. The culture was kept in a beaker on a white background in a window facing east.

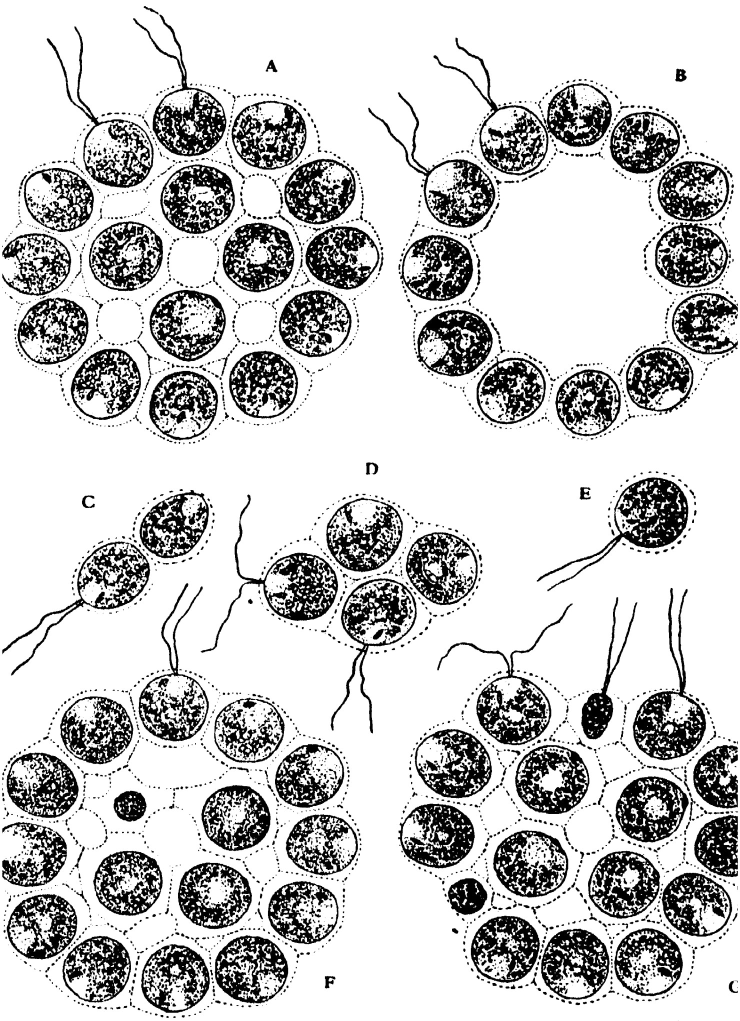
The chief change that took place in the culture was the breaking up of many of the colonies into smaller groups, often very irregular, and generally culminating (as was observed directly in some cases) in the formation of single-celled units. In the fully concentrated solution the cells were nearly all separated or so loose that it was almost impossible to obtain them intact on mounting, as could easily be done when they were in their natural medium. At the time the single-celled units had become predominant in the culture the strength of the solution had increased to nearly standard Knop's. At the same time organic material was being added by the decay of many colonies. A bewildering variety of forms was produced during the process of concentration.

The figures given here show the main types of colonies which were found. The variety of form is due to the occurrence of various intermediates between those figured but which do not require individual description.

Colonies with Reduced Numbers of Cells.

These have been recorded by various authors. Some colonies resembled the irregular and eight-celled abnormal forms figured by Harper (7), who also remarks on the tendency to dissociate. Others were regular four-celled and two-celled combinations as figured here (figs. C, D). Hartmann (8) has obtained similar forms in culture.

The colonies of *Gonium pectorale* consisting of eight, four, and two cells may be produced by reduction in the number of divisions occurring in the parent cell from which they arise. They may also originate, as may colonies of irregular number of cells, by breaking of a fully formed colony. Four-celled colonies most often arise by incomplete division in the parent cells, two-celled colonies more frequently by the breaking up of the larger aggregates. Eight-celled groups are commonly seen to break up into two groups of four each. The binary and quaternary groups made up the bulk of the population, along with a decreasing number of normal sixteen-celled colonies and an increasing number of unicells, during the process of concentration. At the



Normal and abnormal forms of *Gonium pectorale*, Müll.

Flagella are only shown in some of the cells, but are present in all. Common colonial mucilage not shown. The scale measures 25 μ and is divided into 5 μ units.

A. Normal vegetative colony. B. Annular colony due to loss of central cells. C. Two-celled; and D. Four-celled colonies. E. Unicell. F & G. Colonies showing somatic cells in central group (F) and peripheral series (G).

same time the other types shown in the illustration appeared in much smaller numbers. Four-celled units can also develop in the formation of the annular colonies which will be described below.

Various four-celled species of *Gonium* have been described. According to Chodat (2) a four-celled species exists and this must be designated *G. sociale* (Dujard), Warm. (= *G. tetras*, A. Br.). This differs from *G. pectorale*, Müll., in the form of the cells and their contained chromatophore. Hartmann (8) has found by culture that such four-celled forms are genetically distinct. The four-celled colonies recorded here are not to be confused with these forms. I have witnessed their production from undoubted sixteen-celled colonies of the normal *G. pectorale* type, and Chodat (2, p. 122) gives a figure showing the reverse process. Four- and eight-celled colonies probably occur in all collections of *Gonium*. They are mentioned, for example, by G. M. Smith (10) and are figured by Chodat (2). The eight-celled form does not appear to be represented by a distinct species. The mechanical explanation of this will become clear on examination of a figure of such a colony and a consideration of the way in which the organism swims. The central aperture which is necessary for the flow of water through the colony is here found in the relatively narrow central band of mucilage which is commonly seen to break.

In those cases in which reduced colonies arise by breaking they may perhaps be compared with the living fragments of animals (*Merizoa*) recorded in pages of this journal by Gilchrist (6). Even the most irregular fragments of a colony may swim about actively and, to judge from the appearance of their cells, are often carrying out their normal nutritive functions.

Annular Colonies.

The annular colony (shown in fig. B) showed the greatest rarity, being seen only twice in the intact and completed condition. Stages in its production by the escape of the four middle cells were seen. This is a second way in which regular four-celled groups can originate, although the central cells can also escape in pairs or separately. I have not seen the complete dying away of the four central cells *in situ*, although this is also a way in which annular colonies may arise. Sometimes the four central cells of an almost normal sixteen-celled plate are somewhat smaller and may show evidence of disintegration, as will be noted. If the

four central cells which escape in the formation of an annular colony immediately die, as no doubt sometimes occurs, then a condition would be exhibited which can be considered as transitional between the annular and somatic forms.

The annular type of colony (shown in fig. B) is also worthy of mention, since, although it only represents an apparently chance condition amongst numerous irregular forms, due to the breaking away of cells, it shows that *Gonium* can attain a form functionally and in appearance somewhat similar to the genera *Stephanosphæra*, Cohn, and *Stephanoon*, Schewiakoff. The annular colonies of these forms, however, cannot be homologized with those of *Gonium*, and they arise in a totally different manner. The circular form in *Gonium* is always a secondary condition, obtained by the loss of the central cells. It is not a regressive abnormality, but a progressiveone. Thus the annular colonies, in their development, pass through the plakea phase, which is the normal *Gonium* type. There is no loss of cells in *Stephanosphæra*. The circular form is here the primary one. The colony is a plakea and nothing more, differing only from normal *Gonium* in the planes of cell-division which separate its cells. This accounts for the difference in number of cells between *Gonium* (annular form) and *Stephanosphæra*. In the former it is 12, in the latter it is generally 8, more rarely 4, 2, or 1. The envelope-structure also differs (see 3). *Stephanoon* is somewhat similar to *Stephanosphæra*, but has a zone of two rows of cells.

The Unicellular State.

Extreme reduction in number of cells leads to the assumption of the unicellular condition. This reduction has already been studied by Hartmann in *Gonium* (8), and this author compares his results with those obtained by him in *Stephanosphæra* in an earlier work. Unicellular forms of *Gonium* are mentioned by Chodat (2) for *Gonium sociale*, Dujard., and *G. pectorale*, Müll. This author speaks of them as a means of reproduction, and mentions that, in the latter species, their production rarely occurs. This evidently refers to their formation under natural conditions. They serve to propagate the colony, undergoing division, the first noticeable sign of which is the division of the eye-spot (fig. E). The formation of single-celled units from colonies will be familiar to those who have attempted to keep colonial algæ in culture. For example, Tscharna

Rayss (9) found that colonies of *Cœlastrum* tend to separate into rounded or polyhedric unicells in media of increasing concentration and independent of external mechanical action. The result harmonises with W. Ostwald's theory (see 9). Increase of carbon compounds is also a factor in bringing about loss of the colonial character in *Cœlastrum*. The factors would appear to be the same in *Gonium*, since, as the unicells increase, the concentration of salts increased by evaporation and, of available carbon compounds, by decay.

From a phylogenetic point of view, the unicellular forms of *Gonium* represent a reversion to the ancestral genus *Chlamydomonas*. Chodat (2) has pointed out that they are difficult to distinguish from true members of this genus, especially *C. de baryana*, Gorosch. Our specimens had, however, a somewhat wider gelatinous sheath and were often almost spherical.

The behaviour of the unicellular units in our cultures is of some interest. In some cases they retain their flagella and begin to divide. At least the eye-spot is seen to have multiplied in some cases (fig. E). The method of division is then somewhat peculiar in being multiple simultaneous division into probably eight parts. Other unicells develop thick walls and pass into the resting state (hypnocysts).

These unicells may also behave in another way. They may escape and fail to divide. The latter condition leads over to those in which cells which fail to divide are retained in a colony, whilst neighbouring cells are in various stages of division (figs. F, G).

Colonies with Somatic Cells.

The remaining colonies figured (figs. F, G) are peculiar in showing special small cells. These are figured in extreme examples among cells which are not yet dividing. They are more frequent in dividing colonies, where they can be seen undergoing various stages of degeneration. The last stage is one of complete dissolution of the protoplast. A stage figured by G. M. Smith (10) in *Gonium pectorale* from Wisconsin, but not discussed by him, shows a cell-membrane from which the protoplast has disappeared and may have been derived in this way. Generally sterilization of cells is accompanied by decrease of size or failure of growth, followed by shrivelling. Another type of sterilization apparently consists of increase of size in the cells, which become paler and lose their definite contents. In the smaller cells the colour is deep for a long time and the protoplasm

granular. Generally only one cell of a colony is thus affected, but as many as four may become smaller. An actual reduction in size is probably sometimes effected, since the cells often show signs of shrinkage in their irregular outline. They must, however, be regarded as quite equivalent to the vegetative or trophic, as opposed to the reproductive cells, of *Pleodorina*, for example, as they are often darker in colour than the dividing cells and of regular form. In such cases their flagella (fig. G) have been seen to be retained, and the small cell is in other respects apparently normal. A size of only half the normal diameter, which in the adult colonies was 10 to 12 μ, was commonly reached in some of these small cells before any of the large ones had commenced to divide. Occasional cells were even smaller, being not much larger in some cases than the cells when first produced (2–3 μ). Sterilization either affected the inner four cells or the peripheral ring. There appeared to be no other relation in the position of the cells thus becoming somatic. Division in the normal colonies (fig. A) did not occur simultaneously in all the cells, as has been stated for this species (10). For example, when some of the cells of a colony had reached the four-celled stage, others had progressed to the eight-celled or had even completed division. Cells not undergoing division among dividing-cells are also met with, and where these show no signs of degeneration (shrinkage, differential staining) they may be classed as cells which have not yet divided. Yet even some of these may fail to divide and subsequently degenerate. Such cases would represent the beginning of a soma—that would, however, be overlooked.

The true somatic variants (figs. F & G) can be classed into two groups, according as to whether the somatic cells occur in the central group (fig. F) or in the peripheral ring (fig. G). In the former case the variant is homologous with variants of *Eudorina* and *Pandorina*, which I have termed β forms. In these a group of sterile cells occurs at one region of the ellipsoidal colony. Sometimes in the same position there is a single sterile cell. The region in question is the anterior pole of the ellipsoidal colony, and corresponds with the centre of the colony in *Gonium* as shown by development. The variants of *Gonium* in which all or any of the four central cells are somatic, whilst the peripheral cells remain reproductive, will therefore be spoken of as *Gonium* β. If, however, somatization extends to the peripheral ring (fig. G) the variants are to be designated as *Gonium* γ, since they correspond with the scattered type of somatic cell arrangement seen in *Eudorina* and *Pandorina*.

In actual specimens somatic cells were not observed in both central group and peripheral ring, although there seems no reason why these should not occur. Any specimen (*e.g.*, fig. F) in which the peripheral ring is affected will, however, fall in *Gonium* γ.

General.

The prevailing tendency of systematists to omit records of all but typical examples of each species is to be deprecated. It has contributed greatly to the spread of the fallacies of "discontinuous variation" and "constancy of species." But the characters that have become fixed in one species can often be seen in abnormal individuals of another species. Even the well-known occurrence of four-celled colonies in *Gonium pectorale*, Müll., is an example of this. From the above somewhat detailed account of the inter-relations of the abnormal forms of *Gonium* and of their homologies with other forms certain conclusions can be drawn which appear to the writer to be of great importance. It is alleged, as, for example, by Bateson (1), that the conclusions of systematists support the idea of discontinous variation. The difference between the colonial and the unicellular form is regarded as an important systematic distinction, so that *Gonium* is frequently classed in a family distinct from that to which *Chlamydomonas* is assigned. Yet it has been shown that in *Gonium*, by a slight alteration in concentration of the medium, or even sometimes by a mere tap on the cover-glass under which the organisms are mounted, the colonial organization can be changed to a unicellular one—and there is a progression in this respect from *Gonium* to larger colonies. Harper (7) has already pointd out that separation of the cells in the colonies of *Volvox* is very difficult, even by mechanical means. In *Pandorina* and *Eudorina* separation does not occur so readily as in *Gonium*.

Even the important progression from Protozoa to Metazoa is ultimately no more than a change analogous to colony-formation. The origin of the soma was also a great step in evolution, but it had the humblest beginnings, as can be traced in variants, which in *Eudorina* are already sufficiently common and constant to be regarded as distinct forms (*Pleodorina*), less commonly in *Pandorina*, and still more rarely, having so far been only observed under abnormal conditions, in *Gonium*. Thus, in the variations of a species, evolution can be actually seen in progress. There is no need

to minimize the importance of taxonomic grouping because of these facts.

No distinction is so great that discontinuities need be imagined in the course of phylogenesis. The idea of mutation is a perfectly legitimate one, provided it is confined to the differences between two individuals, one of which may happen to be the parent of the other. But, as the writer has shown elsewhere (5), morphological differences can always be arranged in graduated series, and the abnormal forms of *Gonium* furnish an excellent illustration of this truth.

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LXXII.—*Note on the Inclusion of Sand in Sponges.* By

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INTRODUCTION.

Owing to the kindness of the late Professor A. Dendy I recently had an opportunity of reporting on a collection of sponges from Maria Island, Tasmania. In the collection there are a number of examples of sponges whose tissues

are filled with sand to such an extent that the normal skeleton is practically or entirely obliterated. Several of these throw considerable light on the general problem of the inclusion of sand in sponges, and more particularly on the connection between the presence of sand, or other foreign bodies, and the reduction of the spicular skeleton. The investigation of these has led me to attempt a survey of the whole problem in the form of a summary of our present knowledge.

Distribution of Sand-Sponges in the Phylum.

Order CALCAREA.

None.

Order MYXOSPONGIDA.

Only one, *Hexadella kirkpatrickii*, Burton, in which the foreign bodies form a dermal cortex sharply marked off from the choanosome.

Order HEXACTINELLIDA.

None.

Order TETRAXONIDA.

Suborder Homosclerophora.

None.

Suborder Astrotetraxonida.

A few—e. g., *Psammastra murrayi*, Sollas; *Stelletta psammophila*, Burton MS.; *Ancorina geodides* (Carter).

Suborder Stigmatotetraxonida.

Family **Tetillidæ.**

A few—e. g., *Tetilla dactyloidea*, Carter.

Family **Lithistidæ.**

None.

Family **Haplosleridæ.**

Here the inclusion of sand and foreign bodies is very common, especially in sponges with well-developed spongin-fibres.

Family Desmacidonidæ.

In the subfamilies Esperellinæ and Axinellinæ sand-sponges are rare, whereas in the Ectyoninæ they are very common.

Family Clavulidæ.

Very rare.

Order EUCERATOSA.

Very common.

Geographical Distribution of Sand-Sponges.

The great majority occur in Australian Seas, a few in the Indian and Pacific Oceans, a few along the coast of S. Africa, and one at least, *Spongelia fragilis*, is cosmopolitan.

Facts (adduced) and Discussion.

1. The inclusion of sand and foreign spicules is most common where the skeleton includes a certain amount of spongin.

This rather peculiar distribution of sand-sponges in the phylum suggests that, while many sponges have an affinity for sand, it is only those with horny fibres that are able to make any definite use of it, incorporating it in the fibre and so supplementing the skeleton. This is what one might expect, for it would be difficult for a sponge to build up an efficient skeleton of sand without spongin or some such substance to hold the grains together. In sponges in which sand occurs scattered in the choanosome it is possible that it may serve a useful function in supplementing the spicular skeleton and keeping the sponge rigid, but only a certain limited amount can be used in this way, or interference with the normal functions of the sponge would necessarily occur. Any large amount of sand in the choanosome would restrict gametogenesis and embryo formation, and so ultimately lead to the extinction of the species. In the sponge with a horny skeleton the case is different: sand can be used to build up an efficient skeleton and yet not interfere with the physiology of the rest of the sponge, because it can be confined to definite tracts. This suggests one line of explanation of the greater frequency with which sand occurs among sponges with a horny skeleton. There is, of course, an alternative explanation—namely, that the development of spongin to an appreciable extent renders this type of skeleton

unsatisfactory, and it is this deficiency which is the actual cause of the intake of sand.

2. In sponges with the skeleton wholly or partially composed of foreign bodies, these are usually, but not always, found in the centre of the spongin-fibres.

Minchin (1900) was of the opinion that sand-grains adhering to the surface of the sponge were surrounded by the growing point of the fibre and so incorporated as the fibre grew upward. Miss Sollas (1908 B), from a study of the process in *Miyas porphyrion* and *Euspongia officinalis* var. *rotunda*, suggests another way by which the inclusion of sand may take place. In these species pseudopodia-like extensions of the surface-cells surround sand-grains, and the inclusion of sand and foreign bodies is due to the action of amœbocytes, which are also responsible for their conveyance to and orientation in the spongin-fibres. This explanation, as the author suggests, accounts for orientation of the spicules in the fibres and the fact that some species include only sand in their fibres while nearly related species include only foreign spicules. In this connection it is interesting to note that in two of the Maria Island specimens of *Phoriospongia kirkii*, a species which, so far as I am aware, has previously been known to include sand only, the fibres are cored by foreign spicules. However, in separate specimens the fibres are cored by sand *or* foreign spicules, not both, so that there is a definite selection by the sponge, although it is here characteristic of individuals rather than species. This method of inclusion along the whole surface of the sponge, not merely at the tips of the fibres, would account for sand scattered *between* fibres and also for the occurrence of sand in sponges without a horny skeleton.

3. Sometimes the inclusion of sand appears to exert a mechanical influence which hampers spicule-formation and even eliminates certain categories, but, on the other hand, sponges are known where one or more categories may drop out and no sand is included.

That the former is the case in a great many sponges is indicated by the fact that, however sandy the sponge, there are nearly always traces of the original spiculation in some form or another. This is the case in all the Maria Island specimens of *Phoriospongia kirkii*, and in some the reduction in spiculation has gone much further than in others. In *Echinochalina intermedia* and *Echinoclathria arenifera*, where the sand is not entirely confined to the fibres but also scattered through the choanosome, the reduction has gone much further and it is only in relatively clear parts that the true nature of

the skeleton can be seen. Illustrating yet a further step in the formation of a sand-sponge are several specimens quite unidentifiable, in which sand is so abundant that the original spicular skeleton has almost entirely disappeared, only a few scattered spicules remaining. That the action of the sand is in all probability purely mechanical is indicated by the fact that in Esperelline and Ectyonine sponges where sand invades the fibres it is the coring spicules of the fibres which disappear first, the echinating, an auxiliary, and other spicules outside the fibres remaining, although in greatly reduced numbers. The evidence from the Astrotetraxonida also supports this view—e. g., *Stelletta psammophila*, in which there is much sand scattered in the choanosome and the cladii of the triænes of the main skeleton are very much reduced.

Dendy (1926) puts forward the hypothesis that the formation of spicules by the sponge is due to the presence of symbiotic organisms which he terms sclerococci. This theory suggests a way in which reduction and ultimate loss of spicules may take place in a sand-sponge. It is possible that at first the spicules are merely reduced in size, or actually suppressed, in each generation, but that ultimately the pressure of the sand-grains affects the sclerococci responsible for the development of one or more types of spicule, and so causes these to drop out of the spiculation. That the entire suppression of a spicule-category would be a lengthy process is very probable from the fact that representative sclerococci which do not take part in spicule formation are supposed, by Dendy, to exist in the tissues of the sponge. It is these that are handed on by egg-transmission, and, as they occur in the choanosome which is rarely invaded by sand to the same extent as are the fibres, they would be more likely to survive than those which form the basis of spicules. However, in many sand-sponges there is a certain amount of sand scattered in the choanosome, and in these there must be considerable difficulty in embryo formation and the inclusion in the embryos of the proper sclerococci, so that in their descendants a greater reduction of the skeleton apart from mechanical pressure of sand might be expected. Where in some specimens of a sand-sponge a whole spicule category is absent, while in others with just as much sand it is present (*e. g.*, Sigmata and Dermal Styli in the Maria Island specimens of *Phoriospongia kirkii*) the suppression must be accounted for in some way as that roughly outlined above. *i. e.*, by defective egg-transmission due to mechanical hinderance of sand. Further evidence that direct suppression

afresh in each generation is not a sufficient explanation is afforded by specimens of *Phoriospongia kirkii*, where sigmata are absent, and yet strongyla, the other spicules of the choanosome, are present, although sigmata are much the smaller type of spicule and would therefore be expected to be the least affected by sand.

It now remains to consider the other possibility—namely, that sponges with a reduced spiculation take in foreign bodies as a compensation for the loss of the proper skeleton. There are various families in which reduction of skeleton by the complete loss of whole spicule-categories has occurred again and again in various genera and species—*e. g.*, families Stellettidæ and Tetillidæ. Among the "Monaxonellid" species so formed, the inclusion of sand is no more common than in other sponges, and in the genera *Chondrosia* and *Chondrilla* with even more complete reduction of skeleton no sand-sponges are known to occur. This evidence seems to show that, at least among sponges with an entirely spicular skeleton, the loss of one or more spicule-categories does not make the inclusion of sand more likely.

Dendy (1887 B), writing of West Indian Chalinine sponges, states that the siliceous spicules gradually degenerate and ultimately entirely vanish as the horny skeleton becomes more and more strongly developed. He also states that the development of spongin to any extent only takes place in warm climates and shallow water, and that under these conditions spicules (or presumably sand) would be actually harmful to the fibre, rendering it rigid and brittle where it should be elastic and flexible to withstand action of currents and waves. It is a striking fact, however, that these conditions correspond roughly to the conditions under which the majority of sand-sponges grow, and there is the possibility that if the spicular skeleton was suppressed in the above way and then the conditions altered slightly or the sponge extended its distribution into a slightly different locality, the need for a more rigid skeleton might arise again and lead to the inclusion of foreign particles in the fibres. This would explain the scarcity or absence of proper spicules in the fibres as well as does mechanical pressure of sand acting before any degeneration of the skeleton. That such a method of formation of a sand-sponge is at least possible is shown by the genus *Chalinopsilla*, which has undoubtedly been derived from Chalinine sponges with well-developed spiculo-fibre. In this genus about half the recorded number of species have included sand or other foreign bodies in their fibres and so formed secondarily a more or less rigid skeleton.

In this case it is likely that reduction of the skeleton is responsible for the inclusion of sand, but it is reduction due to excessive development of spongin and not to any dropping out of spicule-categories brought about by defective egg-transmission. If, however, defective egg-transmission did result in absence of spicules in the fibres, and it was of advantage to the sponge that its skeleton should be rigid, there is no reason why sand should not be included in the fibres, and it would then be very difficult to decide what was the original cause of the reduction unless stages were known as in the genus *Chalinopsilla*.

4. Incrustations of sand are formed in some sponges and yet none is taken in.

This at once suggests that it is not merely a matter of chance whether sand is included in the tissues of the sponge, for if the inclusion of sand is a haphazard process depending only on whether sand is abundant in the surrounding water or not, sponges in which actual incrustations of sand are formed should be more likely than the majority of sponges to take in sand. It is not merely that certain types of "irritant grains" which fall on the surface are removed into the interior of the sponge and once there put to the best use. Definite selection of a special kind of particle (*vide* Lendenfeld, 1889, p. 768) takes place and the inference is that the sponge has some definite use for these particles.

5. The inclusion of sand in the skeleton occurs chiefly in shallow-water forms growing in warm or moderately warm seas.

With this is bound up the great development of spongin under these conditions, as previously described.

Conclusions.

1. *Reason for the Inclusion of Sand.*

The question arises—Is the inclusion of sand a more or less "conscious" intake to supply some need or make good some deficiency, or is it merely a chance intake due to the presence of large quantities of sand in the environment? On the whole, the facts indicate that the former is more likely to be the case. The method of the inclusion of sand, the selection of special kinds of particles, the evidence from sponges with surface-incrustations but no sand in the interior, all point in this direction. So do the restriction of the sand to the horny fibres (although it might be argued that this is a method of getting rid of the sand so that it

does not interfere with the general functioning of the sponge) and the occurrence of a large number of sand-sponges in the Order Euceratosa and the genus *Chalinopsilla*, where the horny fibres are the only supporting skeleton. On the other hand, other deficiencies of the skeleton, such as loss of whole spicule-categories, are not known to lead to the inclusion of sand. In this connection the work of various authors goes to show that there is a definite tendency in certain animals to include extraneous elements present in the environment rather than build up a skeleton from their own resources. It is not unknown for a Cœlenterate to use the spicules of the sponge on which it grows instead of making its own. *Astrosclera willeyana*, Lister, includes aragonite-forming coral algæ, and from aragonite spherules builds up a very efficient skeleton. In a paper on this species, Kirkpatrick puts forward the view that by building up its skeleton in this way the originally thin incrusting sponge was able to become a disc and the disc a column. As this author points out, it is a habit among Ectyonine sponges to select special kinds of particles from their surroundings and include them in the skeleton, and the reason for this is probably the same as in *Astrosclera*—to attain a firmer and stronger skeleton than is afforded by spiculo-fibre, on which to build up the sponge-body and attain a larger size.

These considerations serve to show that as yet no definite causes conditioning the inclusion of sand can be stated. There are probably many factors of which we know scarcely anything which determine whether a particular sponge shall take in sand. In the genus *Chalinopsilla*, for example, what are the factors which determine that one species shall build up a skeleton of sand, and another, perhaps closely related, shall not? Sometimes, as in *Spongelia, Psammopemma,* and *Phoriospongia kirkii*, whole genera are characterised by the inclusion of sand in the fibres, but often it is only isolated species or even varieties that seem to have a particular affinity for sand. All we can say, as yet, is that there are probably two main factors at work :—

(*a*) A definite "affinity" for sand, with which is bound up the power to make use of the sand or foreign bodies.

(*b*) Favourable circumstances such as sand present on the sea-floor, turbulent currents to deposit it on the sponge, etc.

2. *Method of Inclusion of Sand.*

It appears from the work of Miss Sollas (1908 B) that

the inclusion of sand is the work of pseudopodia-like extensions of the surface and amœbocytes, the latter being responsible for carrying the sand-grains or foreign spicules to the spongin-fibre and giving them a definite orientation.

3. *Reduced Spicular Skeleton of Sand-Sponges.*

As regards the reduction of spicular skeleton so common in horny sponges which include sand or foreign bodies, the process is probably a "reversible reaction." The most we can say is that at times the inclusion of sand may be the cause of the reduction in skeleton, while at others the absence of a sufficient skeleton is favourable to the inclusion of sand.

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LXXIII.—*Note on a new Species of* Notoscolex, *with a List of the Earthworms of Burma.* By G. E. GATES, Rangoon, Burma.

Notoscolex birmanicus, sp. n.

External Characteristics.—Complete immature specimens are 300–600 mm. long and 5–10 mm. wide. The largest mature (?) fragment from an anterior end is 450 mm. long and 10-15 mm. wide. Colour of formalin-preserved specimens creamy white.

The first dorsal pore is in 10/11 and is small; the pore in 11/12 and the ones following are much larger.

The prostomium is prolobous.

There is a single deep secondary furrow on segments iv. and v., behind the setæ of the segment. On segments vi.–xi. there is a single deep furrow anterior to the setæ, and two deep furrows posterior to the setæ. On segment xii. there is a single deep

furrow anterior to the setæ and two very slight furrows posterior to the setæ. Segments xiii.–xvi. have a slight furrow anterior to, and another posterior to, the setæ of the segment. On segment vii. there are many short furrows passing in an antero-posterior direction from one circular furrow to the next.

The setæ begin on segment ii., and are paired. They are not visible externally on most of the specimens anterior to the clitellum, but posterior to the clitellum *ab* is less than *cd*, is less than *bc*, is less than *aa*, while *dd* is greater than one-half of the circumference.

The clitellum begins behind the setæ of segment xii. and extends to 16/17 dorsally and onto xvi. ventrally. Large dorsal pores, inter-segmental furrows, and secondary annulations are visible.

The spermathecal pores are closely paired in region *aa* on the intersegmental furrows 6/7 and 7/8. Each pair of pores is surrounded by a single pair of swollen lips.

The female pores are minute paired apertures on xiii. in *aa*, and are about as far distant from seta *a* of the segment as from each other.

The male pores are invisible externally, but according to the dissections open in the region *aa*.

The only genital marking present is a deep horseshoe-shaped depression on segments xvi.–xix. with the opening of the horseshoe directed posteriorly. The depression is surrounded by a thickened ridge. There are two small club-shaped projections of the body-wall lying in the most anterior and deepest part of the depression. Grooves pass forward in the depression, one on each side, almost in line with seta *c* to and just in front of the projections.

Internal Anatomy.—Septum 5/6 is present but thin, 6/7–10/11 are much thickened, 11/12 is slightly thickened; none are lacking posterior to 5/6.

There is an elongate gizzard in vi. The intestine begins in xiv. Paired, stalked, calciferous glands occur in segments ix.–xiii. with the stalk or duct attached to the alimentary canal just anterior to the posterior septum of the segment.

The last pair of hearts is in segment xii.

There are large nephridial masses in segment vi.

The testes and funnels are free in ix. and x. There are paired seminal vesicles in x. and xi.

The prostates are long, extending into the region of segments xxx.–xxxv. The inner edge of the prostate is straight and smooth, the outer edge is slightly scalloped or very slightly lobed. The prostates lie underneath the intestine, and do not as a rule project around the sides of the alimentary canal. The prostatic duct is 3–5 mm. long. It is first visible just posterior to the anterior end of the prostate and passes straight forward, without curving or twisting, into the body-wall. The vasa deferentia pass back along the side of the prostatic ducts and open into them separately just after their emergence from the prostate-gland. There are numerous

strong iridescent cords on the ventro-lateral parietes in the prostatic region.

The ovaries and oviduct funnels are in the usual positions in segment xii. The spermathecæ are in segments vi. and vii., the duct passing into the body-wall in contact with the nerve-cord in the posterior part of the segment. The duct is short and stout, and not sharply marked off. The ampulla is heart-shaped, with a warty or papillated surface. A single, small, pouch-like diverticulum is attached to the anterior face of the duct close to the ampulla.

Habitat.—Maymyo, F.S.S., Burma. Probably widely spread throughout the Shan plateau.

N. birmanicus differs from most species of the genus in having the organs of the anterior part of the body one segment further forward than normal, and the calciferous glands anterior to, instead of posterior to, the ovarian segment. The only other species with these characteristics occur in the Abor country of Assam to the north-west of Burma. The Burmese species is undoubtedly more closely related to the aberrant Abor forms than to the normal and geographically distant species of the genus in South India and Ceylon. The discovery of *Notoscolex* in Burma is, then, further evidence for the belief that the Oligochæte fauna of the province is more intimately related to that of the north-eastern part of India than has previously been thought, as well as for the belief that the genus *Pheretima* is a much less dominant part of the Oligochæte fauna of Burma than has been hitherto supposed.

Occurrence.—May to October.

Remarks.—An explanation in regard to the lack of complete mature specimens should be given. The most favourable time for securing this worm is in the rainy season, which, roughly speaking, may be said to extend from June to October, but during this period it is not possible for one engaged in educational work to make the long trip required to reach the out-of-the-way district in which the worms occur. Although numerous attempts have been made to secure specimens in the vacation months of May and October, just before and just after the rainy season, the results of such attempts have been unsatisfactory. The usual methods of forcing the worms out of the ground by mechanical and chemical stimulation failed utterly in this case, so that it was necessary to resort to the tedious process of digging to obtain the specimens. In May the ground was very hard and caked by the long dry season. Digging was slow and difficult, and results were sparse. In October the ground was drying, and the clayey soil was of such a consistency that digging was again slow and difficult.

As the result of fairly extensive digging by gangs of coolies, a few immature specimens (complete) and fragments of worms probably mature were secured. Friends of the writer have observed at rare intervals, crawling about on the surface of the

ground after heavy rain-storms, single worms which were said to have measured from three to seven feet in length, but, unfortunately, these were so poorly preserved as to be of no value at all. It is not therefore possible to make any further statement as to the length of this worm, except that it is the longest worm yet reported from Burma.

In addition to its size, the present specimen is also interesting because of its relation to the surface-layer of soil. *N. birmanicus* forms tower-like castings in such numbers as to be of considerable nuisance to those householders in Maymyo (the summer capital of Burma) who attempt to maintain grass lawns, tennis, or badminton courts. A medium-sized casting picked at random from a large number available on such a lawn is 120 mm. high and weighs one and one-eighth pounds after four months of drying in rainless tropical weather. Another, the largest visible on the same lawn, is 150 mm. high, over 400 mm. in circumference, and, after a similar period of drying, weighs three and one-quarter pounds. This latter amount does not, however, represent the original total weight. The casting is roughly conical, having been worn off to this condition by the weathering action of storms after its formation in the latter part of the rainy season. What the original weight may have been it is impossible to suggest. Both castings just mentioned are of fine soil without leaves, sticks, stones, or intrusions of any kind. Numerous burrows have been filled with material similar to that of the rest of the casting. A single vertical burrow, the one last used is empty.

No records were made as to the frequency of the worm "towers" in a given area, but when found at all the castings were numerous and often very close together. As the number of worms in a definite area seems to be small, judging by the results of digging, it is probable that a single worm forms many such "towers" during the course of one season.

Castings of this species were also found at such places as on well-rolled tennis-courts, in forest-reserves, at the edges of metalled roads, and on a little-used but weedless sidewalk. In the latter case, the worms had worked their way up through more than three inches of closely packed stone metalling. The castings found several times at the sides of roads, within the metalled area, but on the edge where the traffic had been so slight as not to disturb the original condition of the metalling, were slightly smaller than those observed in more favourable locations.

When the recently formed and still soft part of a casting is slowly lifted off from the harder part of the "tower" in the daytime, the posterior end of the worm is usually visible 5–15 mm. from the entrance to the burrow. After a period of ten to sixty minutes, if no sudden shock or breath of air has startled the worm, it pushes the posterior end up to the opening of the burrow and, moving it around in a circle, deposits a mass of semi-liquid mud which closes the opening. The newly deposited mud has a

yellowish colour and shiny aspect, changing slowly to a darker dull greyish shade as the water evaporates. Although the exposed posterior end of a worm is quickly withdrawn if stimulated by touch, a sudden breath of air, or shock to the neighbouring ground, it does not seem to respond to changes in light intensity. Several times the direct rays of the sun have been observed to fall on an exposed posterior end as a cloud passed from before the sun, but without visible response.

The rate of formation of castings varies widely. Some "towers" increase in size only slowly, a very small amount of new material being added daily or at infrequent intervals. Others are formed much more rapidly, a casting 200-250 mm. high, for instance, being built up in three or four days. The rate of formation seems to be most rapid, in cases observed, in the early stages of building the "tower" or in building a new casting after an old one has been removed.

Mature, and hence identifiable, worms have been only obtained from Maymyo, but castings similar to those formed at that place by *N. birmanicus* are widely found throughout the Shan Plateau (Federated Shan States). In Kalaw, where it is the custom of the forest-officials to burn off the fallen leaves in the forest-reserves at the close of the dry season, the bare ground between the bases of the trees and shrubs in such burnt-over areas is almost literally covered with the tower-like castings.

The vast majority of the castings formed, especially in the hilly forest-reserves, are washed away by the heavy driving rains. A few that have survived the rainy weather as small rounded or conical mounds are to be found in the winter months. Yet in the dry season the ground is thickly dotted with castings, nearly all tower-shaped, just as when they hardened and without signs of erosion. These must have been formed after the heavy storms were over. Without actual studies on the spot during the course of a rainy season it is impossible even to hint at the amount of work done by these worms, but the total weight of finely divided soil brought to the surface on an acre must be very great.

The Earthworms of Burma.

The most recent list of Oligochæta from Burma is that by Stephenson, in his "Oligochæta" of the Fauna of British India Series (1923). Since the publication of that work numerous worms have been described from this province, among which are genera not hitherto recorded from Burma, such as *Pontodrilus*, *Notoscolex*, *Octochætus*, *Ramiella*, etc. The present list, which includes all species recorded from Burma up to the present time, will, therefore, be of interest to those who are concerned with zoogeographical relationships of earthworms, especially those which involve Burma. The area which Stephenson includes within his Burma region is composed of Burma proper, the Andaman and Nicobar islands, and the district of Rangamati

(Bengal). In the following list each of these areas is considered separately.

BURMA.

(Burma proper, including Arakan, but not the neighbouring islands and Rangamati.)

1. *Desmogaster doriæ.*
2. *Eupolygaster browni.*
3. Drawida barwelli typica and var. hehoensis.
4. —— *cærulea.*
5. —— *fluviatilis.*
6. —— *gracilis.*
7. —— *longatria.*
8. —— *peguana.*
9. —— *rangoonensis.*
10. —— *rara.*
11. —— *tecta.*
12. Pontodrilus bermudensis.
13. *Woodwardia burkilli.*
14. *Notoscolex birmanicus.*
15. Megascolex mauritii.
16. *Pheretima anomala* (?).
17. —— *andersoni.*
18. —— *birmanica.*
19. —— *bournei.*
20. —— *carinensis.*
21. —— elongata.
22. —— *feæ.*
23. Pheretima hawayana.
24. —— heterochæta.
25. —— houlleti typica.
    —— —— tortuosa *.
    —— —— *rugosa* * ?.
26. —— *insolita.*
27. —— lignicola.
28. —— peguana.
29. —— *planata* §.
30. —— posthuma.
31. *Perionyx arboricola.*
32. —— excavatus.
33. —— fulvus.
34. —— *m'intoshi.*
35. *Octochætus birmanicus.*
36. *Eutyphœus foveatus.*
37. —— *peguanus.*
38. —— *rarus.*
39. —— *spinulosus.*
40. *Ramiella parva.*
41. Glyphidrilus papillatus.
42. Pontoscolex corethrurus.

Species in italics are endemic, so far as is known at present.
(?) May not be endemic, reported from the Botanical Gardens in Calcutta.
*. May be species instead of varieties.
?. May be endemic.
§. Rather widely distributed in Burma, may eventually be shown not to be limited to Burma.

Burma proper is characterized by the possession of the Moniligastrine *Desmogaster*, *Eupolygaster*, and *Drawida*, the Megascolecine *Woodwardia* †, *Notoscolex*, *Pheretima*, and *Perionyx*, and the Octochætine *Octochætus*, *Eutyphœus*, and *Ramiella*.

THE DISTRICT OF RANGAMATI.

1. *Drawida affinis.*
2. —— *hodgarti.*
3. —— nepalensis.
4. —— *papillifer.*
5. —— *rangamatiana.*
6. Pheretima hawayana.
7. —— heterochæta.
8. *Eutyphœus gigas.*
9. *Eudichogaster chittagongensis.*
10. Dichogaster bolaui.

This district is characterized by the possession of endemic species of the Moniligastrine *Drawida* and the Octochætine *Eutyphœus* and *Eudichogaster*. No endemic Megascolecine forms have been reported. It is evident from the list given above,

† This genus has been found only in the Sandoway district.

however, that the terrestrial Oligochæte fauna of this region is only incompletely known at the present time. It should be noted that this statement applies also to parts of the Burma region proper and possibly in less degree to the Andaman Islands.

THE ANDAMAN ISLANDS.

1. Drawida burchardi.
2. Megascolex mauritii.
3. *Pheretima andamanensis.*
4. — *harrietensis.*
5. — lignicola.
6. *Pheretima osmastoni.*
7. — — *suctoria.*
8. — *wimberleyana.*
9. Ocnerodrilus occidentalis.

The only endemic species reported from this group of islands belong to the genus *Pheretima.*

NICOBAR ISLAND.

1. Holodrilus fœtidus.
2. Lumbricus rubellus.

No endemic species reported hitherto. Peregrine Lumbricids present.

The Burma region of Stephenson may be said, on the basis of our present knowledge, to consist of at least four sub-regions: the Andaman islands, where *Pheretima* is the characteristic earthworm; Rangamati, where *Drawida* is the characteristic genus; Nicobar island, where there are no endemic worms, but peregrine Lumbricids are found; and Burma proper. The latter is characterized by possession of endemic species of the three subfamilies: Moniligastrinæ, Megascolecinæ, and Octochætinæ.

LXXIV.—*New* Halticidæ (*Coleoptera*) *from Africa and Haiti.* By G. E. BRYANT, Entomological Assistant, Imperial Bureau of Entomology.

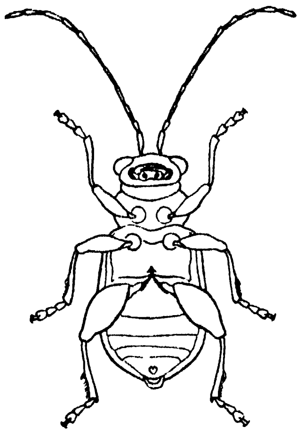
Chalænus viridis, sp. n. (Figs. 1 & 2.)

♂ ♀. Oblong-ovate, convex, entirely metallic green, with the exception of the basal half of the last nine joints of the antennæ, basal third of the tibiæ, and the tarsi fuscous, the underside more coppery. Prothorax slightly transverse and strongly punctured. Scutellum triangular, impunctate. Elytra strongly punctate-striate, somewhat confused at the base and feebler toward the apex. L. 3–4 mm.

Head metallic green, scarcely narrower than the prothorax; face flattened, broad and subquadrate; front transversely impressed, and with a feeble polished longitudinal carina extending from between the insertion of the

antennæ, surrounded by scattered ashy pubescence; eyes very prominent; the vertex of the head strongly punctured, the basal portion very finely shagreened. Antennæ long

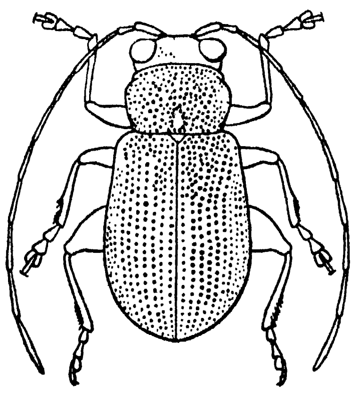
Fig. 1.



Chalcœnus viridis, sp. n., ♂. × 10.

and slender, not quite reaching the apex of the elytra in the ♂, longer in ♀; the two basal joints metallic green, the first joint fuscous at the base at its insertion, broader and

Fig. 2.



Chalcœnus viridis, sp. n., ♀. × 10.

twice as long as the second, the nine terminal joints long and slender, about equal to each other, with the basal half fuscous. Prothorax slightly transverse, metallic green,

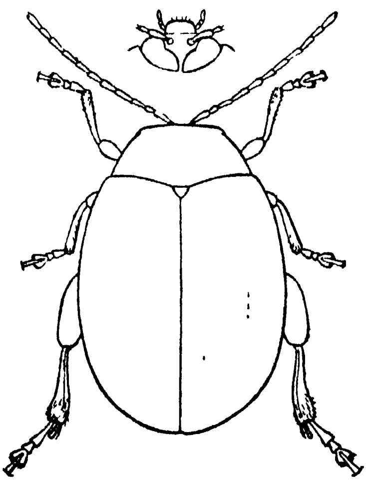
strongly and rugosely punctured, widest before middle, with a smooth longitudinal patch in the centre near the base. Scutellum triangular, impunctate, greenish bronze. Elytra oblong, convex, slightly broader than the prothorax, broadest behind middle, rounded at apex, metallic green, strongly punctate-striate, the striæ becoming feebler towards the apex and more confused at the base. Legs metallic green, with the exception of the basal third of the tibia and tarsi fuscous; the femora with short ashy pubescence, the hind pair more dilated; the apical half of the hind tibiæ fringed with hairs; the claws appendiculate at the base. Underside more coppery; the front coxal cavities closed; the ventral segments very finely punctured and the apical segment notched (♂, fig. 1).

SIERRA LEONE: Makrambe, 26. ix. 1924 (*E. Hargreaves*).

Paradibolia cœrulea, sp. n. (Fig. 3.)

Subrotundate, convex, nitid; above metallic blue, the antennæ with the three basal joints fulvous; the elytra very finely and obsoletely striate; the underside with the sternum blue-black and the ventral segments fuscous. L. 4 mm.

Fig. 3.



Paradibolia cœrulea, sp. n. × 10.

Head small, metallic blue, sunk in the prothorax, the labrum black; eyes large and reniform, nearly contiguous at the apex; the antennæ extending to the middle of the elytra, the three basal joints fulvous, the fourth to eleventh

fuscous, the first joint about equal to the second and third together. Prothorax metallic blue, more than twice as broad as long, with the sides longitudinally impressed, finely and rugosely punctured, nitid; scutellum triangular, metallic blue, impunctate. Elytra metallic blue, very finely punctate, with obsolete sulcate striæ. Legs fuscous, with short ashy pubescence, the apex of the tibiæ slightly lighter in colour; underside with the sternum black and the ventral segments fuscous, with short pubescence.

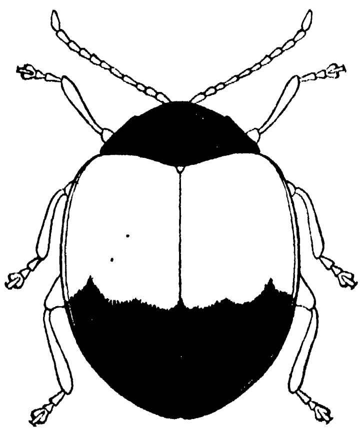
SIERRA LEONE: Boia, 11.x.1925 (*E. Hargreaves*).

Closely allied to *P. indica*, Baly, but differs in the darker underside, the antennæ with only the three basal joints fulvous, the darker tibiæ, and the more obsolete elytral striæ.

Sphæroderma ritchiei, sp. n. (Fig. 4.)

Ovately rounded, fulvous; the antennæ and legs piceous, with the hind femora fuscous; prothorax black and finely punctured, with the anterior angles fulvous; elytra fulvous, with the apex black, finely punctured in double rows. L. 2·50 mm.

Fig. 4.



Sphæroderma ritchiei, sp. n. × 10.

Head with the front and labrum piceous, the basal half black and polished, a deep transverse impression between the eyes dividing the two colours; the antennæ with all the joints piceous, extending to about the middle of the elytra, the first joint twice as long as the second. Prothorax black, polished and with very fine scattered punctures, twice as

broad as long, widest at the base, narrowed in front, the anterior angles obliquely thickened and fulvous. Scutellum small and impunctate. Elytra broader at the base than the prothorax, fulvous, with the apex black, very finely punctured in double rows, becoming feebler towards the apex. Legs piceous, with the hind femora fuscous. Underside fulvous with short scattered pubescence, the first ventral segment the longest, the remaining segments about equal to each other.

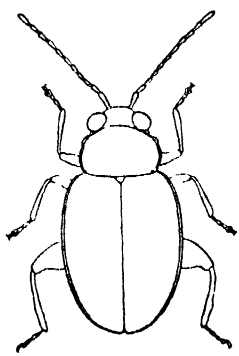
TANGANYIKA TERRITORY: Morogoro, 10. vi. 1922, three specimens (*A. H. Ritchie*).

This will probably prove to be a variable species, with the black apex of the elytra varying in extent, as one specimen before me is entirely fulvous. Somewhat allied to, but much smaller than, *S. discoidalis*, Jac.

Aphthona guavæ, sp. n. (Fig. 5.)

♂. Ovate, entirely black with the exception of the legs and the four basal joints of the antennæ flavous; the hind femora fuscous; the prothorax very finely, almost imperceptibly, punctured; the elytra feebly punctate-striate. L. 1·50–1·60 mm.

Fig. 5.



Aphthona guavæ, sp. n. × 20.

Head black, with a short feeble longitudinal carina between the insertions of the antennæ, a feeble transverse impression between the eyes; the antennæ reaching almost to the middle of the elytra, the first joint about as long as the second and third together, the four basal joints flavous, the fifth slightly fuscous, and the remaining terminal joints darker. Prothorax black, transverse, very finely and almost imperceptibly punctured, broader than the head, the sides

slightly rounded, with the anterior angles oblique. Elytra black, broader than the base of the prothorax, and three times as long, rounded at the apex, finely punctate-striate, the striæ becoming feebler towards the apex. Legs flavous, with the posterior femora fuscous. Underside black, with the first ventral segment about equal to the second and third, the apical segment strongly notched.

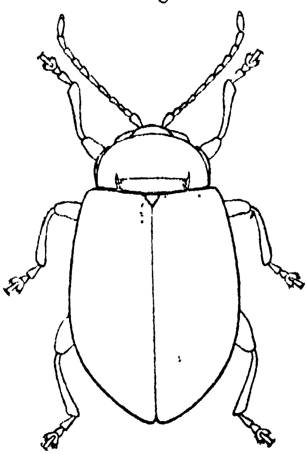
SIERRA LEONE: Moyamba, 29. i. 1925; Port Lokko, 30. viii. 1925 (*E. Hargreaves*); three specimens on guava-trees.

Allied to *A. hargreavesi*, Bryant.

Crepidodera jonesi, sp. n. (Fig. 6.)

♂. Black with metallic tinge, the second and third joints of the antennæ fulvous; prothorax black with metallic tinge, impunctate, with deep transverse and perpendicular sulci at base; elytra cupreo-æneous, distinctly punctate-striate. L. 3·50 mm.

Fig. 6.



Crepidodera jonesi, sp. n. × 10.

Head black with slight metallic tinge, impunctate, labrum black. Antennæ black with grey pubescence, reaching to about the middle of the elytra, the second and third joints fulvous, the first joint longer and broader than the second, the second, third, and fourth about equal to each other, the fifth longer than the fourth or sixth, the sixth to eleventh about equal to each other. Prothorax black with metallic tinge, impunctate, transverse, with a deep transverse sulcus

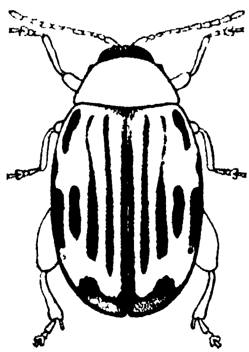
near the base (not extending to the sides) and a short longitudinal sulcus at each end of it, the sides slightly narrowed in front, widest a little before the middle, almost parallel in the basal half, but slightly contracted to the base. Scutellum triangular, impunctate. Elytra wider at the base than the prothorax, cupreo-æneous, punctate-striate, the sides nearly parallel and rounded to the apex. Underside black with metallic reflections; metasternum almost impunctate; the ventral segments with short grey pubescence, the first segment about equal to the second and third together. Legs black, the femora with metallic tinge, the tibiæ at the base touched with fulvous, front tarsi with the first joint broader and stouter than the second.

S. RHODESIA: Hope Fountain, 2. xii. 1922, two specimens (*Rev. Neville Jones*).

Megistops wolcotti, sp. n. (Fig. 7.)

Oval, convex, entirely pale testaceous, with the exception of an intricate pattern of five black-brown vittæ on each elytron and a transverse waved band before the apex, the underside slightly fuscous. Length 2·50 mm.

Fig. 7.



Megistops wolcotti, sp. n. × 14.

Head exserted, pale testaceous, the eyes large and contiguous; the antennæ testaceous with the three basal joints paler, extending a little beyond the shoulder. Prothorax transverse, pale testaceous, finely punctured, broadest behind, the anterior angles prominent and rounded. Elytra pale testaceous, very finely punctured, with a black-brown sutural line, which just before the apex expands into a transverse waved band; each elytron has five black-brown vittæ,

the inner two the longest, starting near the base but not reaching the transverse band; also two short vittæ extending from the middle but not reaching the transverse band, and a short black-brown vitta on the shoulder extending a short way, but not reaching the marginal vitta. Underside slightly fuscous, and the legs clothed with short grey scattered pubescence.

HAITI: Port au Prince, on *Catalpa longissima*, v. 1925 (*G. N. Wolcott*).

Allied to *M. fictor*, Wse., from Porto Rico.

LXXV.—*A Sub-brachypterous Male of* Peloridium hammoniorum, *Breddin* (*Heteroptera*, Peloridiidæ). By W. E. CHINA.

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PELORIDIUM HAMMONIORUM was first described by Breddin * in 1897 from a single macropterous male (fig. b), collected by Dr. Michaelsen in the forest at Puerto Toro, Navarin Island, Tierra del Fuego. In 1907 (not 1899, as stated by Bergroth), Haglund † described a single sub-brachypterous female (fig. c), apparently of the same species, under the name *Nordenskjoldiella insignis*. This female was taken under a decaying tree-trunk in the forest around Punta Arenas, on the northern shore of the Magellan Straits. For many years these two specimens remained the only known examples of this extraordinary family. In August 1924, however, Bergroth ‡ described a new genus and species, *Xenophyes cascus* (fig. d), from a single adult specimen taken (together with a single nymph) by Mr. H. Hamilton whilst sifting leaf-mould in the forest at Ohakune, North Island, New Zealand. At the same time Bergroth recorded a nymph of an unknown Peloridiid genus from Lord Howe Is., about 400 miles off the coast of N.S. Wales, collected by Mr. A. M. Lea. The following month the present writer § described another new genus and species, *Hemiodœcus leai* (fig. f), based on two specimens (1 ♂, 1 ♀) collected at Hobart,

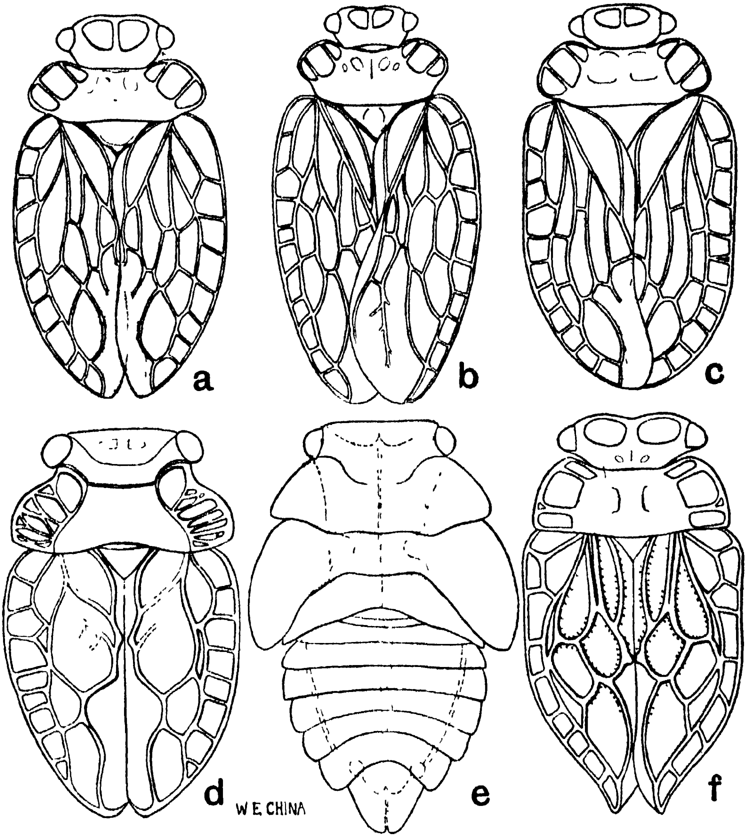
* 'Ergebnisse der Hamburger Magalhaenischen Sammelreise,' ii., Hemipt. pp. 10–13, pl. i. figs. 4, 4 *a–f* (1897).

† 'Svenska expeditionen till Magellänstanderna,' ii. no. 9, pp. 176–178, figs. 1–4 (1907).

‡ Entom. Monthly Mag. lx. pp. 178–181, fig. (1924).

§ *Tom. cit.* pp. 199–203, figs. (1924).

Tasmania, by Mr. A. M. Lea. In 1926, Myers* described and figured the nymph of *Xenophyes cascus* (fig. e), which



Peloridium hammoniorum, Breddin.—**a**, sub-brachypterous male from Valle del Lago Blanco, Chubut, Patagonia; **b**, macropterous male from Puerto Toro, Navarin Is., Tierra del Fuego (after Breddin); **c**, sub-brachypterous female from Punta Arenas, Magellan Straits (after Haglund).

Xenophyes cascus, Bergroth.—**d**, sub-brachypterous specimen from Ohakune, North Island, New Zealand (after Bergroth); **e**, nymph from same locality (after Myers).

Hemiodœcus leai, China.—**f**, sub-brachypterous female from Hobart, Tasmania.

Mr. H. Hamilton had collected with the unique typical specimen. At the same time he gave an interesting and

* Trans. New Zealand Institute, lvi. pp. 465-468, figs. 1-5 (1926).

detailed description of the vegetation at the spot where the specimens of *Xenophyes* had been found. In spite of several energetic attempts to obtain more material, none was found.

During his recent expedition in Patagonia, Mr. F. W. Edwards, of the British Museum (Nat. Hist.), made a special endeavour to obtain specimens of *Peloridium hammoniorum*, Bredd., but without success. It would seem, therefore, that the members of this family are extremely rare, only five adult specimens and two nymphs (comprising three genera) having been recorded during a period of thirty years. The recording of still another specimen (the third) of *Peloridium hammoniorum*, Bredd., is thus of particular interest. While recently examining the large accumulation of unworked material of Hemiptera in the British Museum (Nat. Hist.), the writer discovered a well-preserved specimen of this species, collected by K. Koslowsky, in the Valle del Lago Blanco, Territory of Chubut, Argentine Patagonia (1900). This is a much more northern locality than those hitherto recorded, but apparently the remnants of the ancient antarctic fauna, to which this family belongs, extend up to the 40th parallel of latitude. The most interesting point about this third specimen is that it differs from the two already described by Breddin and Haglund. It is, in fact, a sub-brachypterous male (fig. a). There is, of course, a possibility that these three specimens are not conspecific. When more material has been obtained, and more detailed anatomical studies have been carried out, it is possible that the species will be split up. At present, however, it is best to regard the known material from Patagonia as representing a single species. Attention is called to the characters distinguishing the sub-brachypterous male from the macropterous one. The pronotum, as is usual in brachypterous forms, is shorter and much less developed posteriorly, and resembles that in the sub-brachypterous female. In the macropterous specimen the hemelytral membrane is well developed, and two nervures of the corium (brachial and cubital?) extend on to it; the claval suture is distinct, and the anal nervure of the clavus is present running along the claval suture on the opposite side to the brachial (?) nervure. The hind wings are large. In the sub-brachypterous male and female, the clavus is more or less fused with the corium, the anal nervure of the clavus is absent, and the membrane is abbreviated with the brachial (?) and cubital (?) nervures stopping short at the apical margin of the corium. The hind wings are rudimentary or absent. Breddin's and Haglund's specimens are only known to me by the figures and descriptions, so that

the exact structure, especially of the scutellum, is doubtful. In the British Museum specimen, however, the scutellum is apically bisinuate, and distinctly elevated, while the disc is concave. The venation in the Peloridiidæ is by no means constant in detail, the number and shape of the cells of the costal area being very variable even in the two hemelytra of the same specimen.

In the 'Entomologist's Monthly Magazine' for September 1924 (foot of page 202), attention was drawn to the peculiar structure of the prosternum in the Peloridiidæ, whereby the base of the rostrum passes apparently below it. This character is exhibited to a less extent in many Scutellerinæ (Pentatomidæ), and is strikingly exhibited by species of *Coleotichus*. The prosternum between the front coxæ is deeply grooved, and the lateral margins of the groove are strongly foliately expanded, more or less overlying the groove through which the rostrum passes. If these foliate lobes were to meet in the middle, we should have the condition present in Peloridiids in which the base of the rostrum is completely covered. The position of the insertion of the antennæ in the Scutellerinæ is also more or less the same as in the Peloridiidæ, the antenniferous tubercles being on the under surface of the head between the eyes. Another Pentatomid genus *Phlœa* (Phlœinæ) resembles the Peloridiids in having three-jointed antennæ.

All three specimens of *Peloridium hammoniorum* have been figured together with *Xenophyes cascus* and *Hemiodœcus leai* for comparison. Only sub-brachypterous forms of *Xenophyes* and *Hemiodœcus* are known.

LXXVI.—*Synonymic Notes on* Jassoidea *and* Membracidæ. By W. E. China.

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The following genera and species described by Dr. Goding in the family Membracidæ must be transferred to the superfamily Jassoidea, family Cicadellidæ, tribe Ciccini:—

Williamsiana, Goding (Trans. Am. Ent. Soc. lii. p. 103, 1926). This genus is synonymous with *Zyzzogeton*, Breddin (Societas Ent. xvi. p. 178, 1902), and the type-species *W. ferruginosa*, Goding, is closely allied to, if not synonymous with, *Z. mazaria*, Distant, from Colombia, Ecuador, and Peru.

Eustollia, Goding (Trans. Am. Ent. Soc. lii. p. 105, 1926). This genus is synonymous with *Proconia*, Lep. & Serv. (Encyc. Méth. x. p. 610, 1828), since it is founded according to the author on the insect described and figured by Stoll in his 'Cigales,' p. 37, pl. vii. fig. 34, 1788. As long ago as 1832 (Ann. Soc. Ent. France, i. p. 223, pl. vi. fig. 2) Laporte made this particular figure of Stoll's the basis of a new genus and species, *Germaria cucullata*, Laporte, which he refigured, and later Signoret, in his 'Revue des Tettigonides,' 1855, pointed out that *cucullata*, Laporte, was synonymous with *marmorata*, Fabricius, and *cristata*, Fabricius, which latter Lepeletier and Serville had previously made the type of the first division of their new genus *Proconia*.

Dr. Goding states that the genotype of *Eustollia* is *Cicada jubata*, Stoll, but, since Stoll's work contains no Latin names *, it would appear that *Cicada jubata* is Dr. Goding's own name for the species represented by Stoll's figure, and cannot be attributed to Stoll. He also states that the locality of the genotype is unknown, although Stoll, in his work which is entitled 'Représentation exactement colorée d'après nature des Cigales qui se trouvent dans les quatre parties du monde, L'Europe, L'Asie, L'Afrique et L'Amérique," says "On la trouve à Surinam."

The genus *Eustollia* is also made to include *Tropidaspis cornuta*, Haviland, and *Tolania punctata*, Met. & Brun. If he believed this to be correct, it is difficult to understand why Dr. Goding should have selected such an obscure species as his *Cicada jubata* for the genotype of *Eustollia*, when he had the choice of these two well-described and figured species, the types of which are readily available for study. As a matter of fact, whatever the generic position of each species may be, *Tropidaspis cornuta*, Hav., is perfectly distinct generically from *Tolania punctata*, M. & B., and, moreover, both are true Membracids having nothing to do with the Jassid genus which Goding has described as *Eustollia*.

The synonymy of these genera and species is as follows:—

ZYZZOGETON, Breddin.

1902. *Zyzzogeton*, Breddin, Societas Ent. xvi. p. 178. Type, *Z. hænschi*, Bredd. (Ecuador).
1926. *Williamsiana*, Goding, Trans. Amer. Ent. Soc. lii. p. 103, fig. (syn. nov.).

* In Stoll's work on the Orthoptera, Latin names were given to the species in an Appendix by Houttyn.

Zyzzogeton mazaria, Dist.

1908. *Zyzzogeton mazaria*, Distant, Ann. & Mag. Nat. Hist. (8) ii. p. 84.
1926. *Williamsiana ferruginosa*, Goding, Trans. Amer. Ent. Soc. lii. p. 103, fig. (syn. nov.).

PROCONIA, Lep. & Serv.

1828. *Proconia*, Lepeletier & Serville, Encyc. Méth. x. p. 610.
1832. *Germaria*, Laporte, Ann. Soc. Ent. France, i. p. 222 (preoccupied by *Germaria*, Desv., 1830).
1900. *Zyzza*, Kirkaldy, Entomologist, xxxiii. p. 243 (new name for *Germaria*, Laporte).
1926. *Eustollia*, Goding, Trans. Am. Ent. Soc. lii. p. 105 (syn. nov.).

Proconia marmorata, F.

1788. Stoll, Cigales, p. 37, pl. vii. fig. 34.
1803. *Cicada marmorata*, Fabricius, Syst. Rhyng. p. 61, 1.
1803. *Cicada cristata*, Fabricius, *tom. cit.* p. 62, 4.
1832. *Germaria cucullata*, Laporte, Ann. Soc. Ent. France, i. p. 223, pl. vi. fig. 2.
1835. *Tettigonia marmorata*, Burmeister, Handb. d. Ent. ii. p. 119.
1851. *Germaria marmorata*, Walker, List Homopt. Ins. iii. p. 782.
1851. *Germaria cristata*, Walker, *loc. cit.*
1855. *Tettigonia marmorata*, Signoret, Ann. Soc. Ent. France, (3) iii. p. 765, pl. xxiii. fig. 1.
1858. *Germaria dorsicrista*, Walker, Ins. Saundersiana, p. 97.
1869. *Germaria marmorata*, Stål, Hemipt. Fabric. ii. p. 59.
1900. *Zyzza cucullata*, Kirkaldy, Entomologist, xxxiii. p. 243.
1908. *Proconia marmorata*, Distant, Ann. & Mag. Nat. Hist. (8) ii. p. 83 (cites *marmorata*, F., as type of *Proconia*).
1926. *Cicada jubata*, Goding, Trans. Am. Ent. Soc. lii. p. 105 (syn. nov.).
1926. *Eustollia jubata*, Goding, *loc. cit.* (syn. nov.).

LXXVII.—*A new Nematode of the Subfamily* Anisakinæ. By E. A. SPAUL, Ph.D., B.Sc., Birkbeck College (University of London).

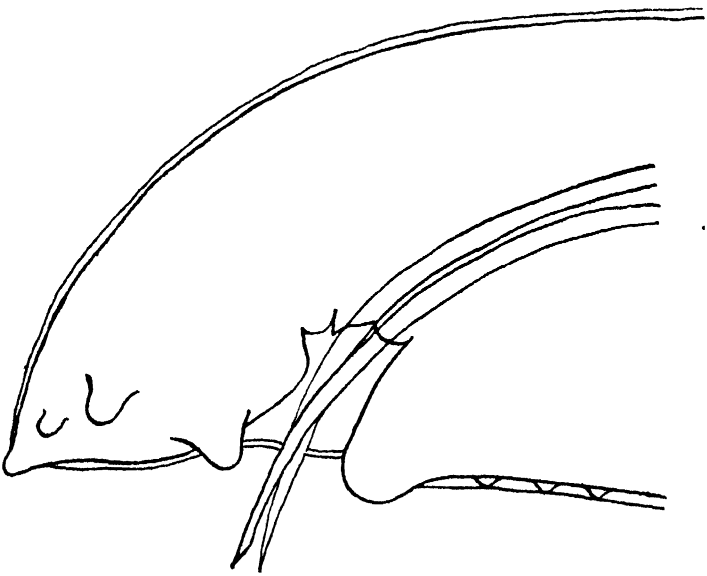
A SPECIMEN of the deep-sea angler-fish, *Himantolophus grœnlandicus* (probably from Iceland), was sent to the British Museum by the Aberdeen Fisheries Laboratory in May 1925. It was found to contain a number of Nematode worms bearing a close resemblance to the genus *Contracæcum*, yet possessing features approaching those of other genera of the subfamily Anisakinæ, so that it appears necessary to establish a new genus within this subfamily.

The material included mature and immature individuals of both sexes, but their detailed examination was difficult owing to imperfect preservation.

Heterotyphlum himantolophi, gen. et sp. n.

The average measurements of the mature males and females are given in the accompanying table. The variations were small, but comparisons between the mature and immature forms of either sex showed great differences in thickness and length, but practically no variation in the dimensions of the œsophagus and cæca except in small specimens, suggesting that growth takes place in the body-region only to accommodate the generative organs, during the process of maturing.

Fig. 1.



Side-view of posterior end of male, showing tail, spicules, anus at bottom of depression, raised anterior lip of depression, postanal papillæ, and last three preanal papillæ.

The body is long, gradually increasing in width from the anterior to the posterior end. The cuticle is transversely striated; the subcuticular layer thick, and the lateral fields well defined. There are three asymmetrical lips having marginal cuticular extensions. The anterior border of the lip is divided by a slight depression into two unequal lobes. The dorsal lip shows a tendency to be smaller than the ventro-lateral lips. Each lip has apparently two unequal papillæ, the larger lozenge-shaped, the smaller a rounded or

conical process. No interlabia or dentigerous ridges are present. The œsophagus is narrow anteriorly, but increases gradually and uniformly in diameter towards the posterior end. The œsophagus is striated in contrast to the short

Fig. 2.

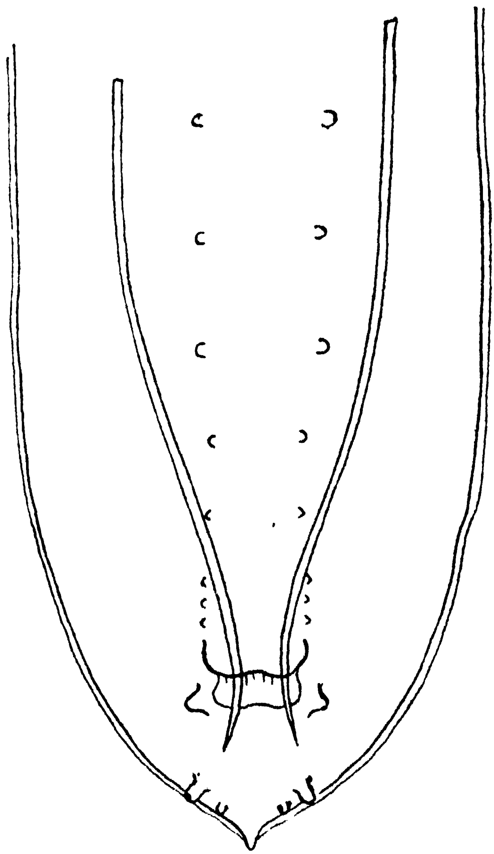
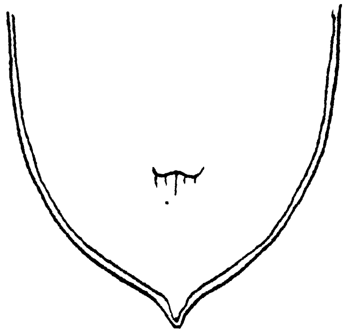


Diagram of ventral view of posterior end of male, showing spicules, depression at anus, postanal papillæ, and last eight pairs of preanal

non-striated ventriculus, of smaller diameter, between it and the intestine. The intestine has thick uneven walls, and is approximately the same diameter as the posterior end of the œsophagus. Posteriorly the intestine, which remains about

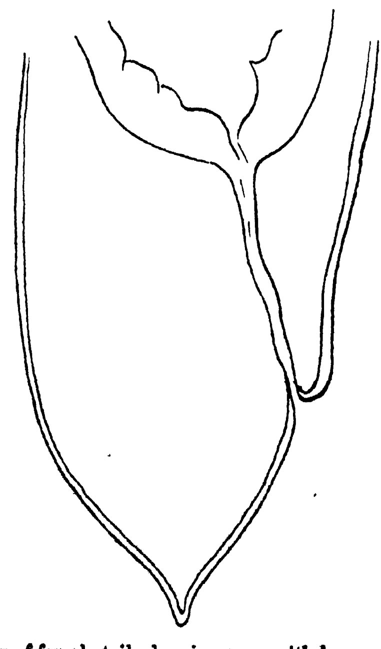
Fig. 3.



The ventral view of female tail, showing anus.

the same width throughout its length, passes abruptly into the straight, narrow, thin-walled rectum. The ventriculus gives off a median ventral cæcum passing posteriorly

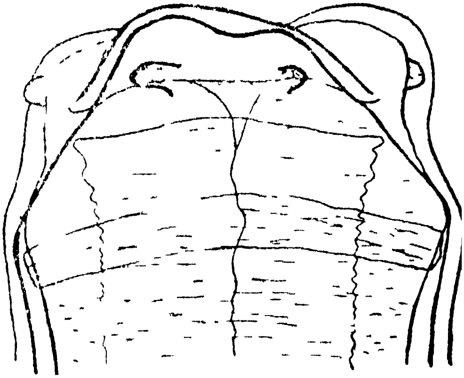
Fig. 4.



Side-view of female tail, showing anus with large anterior lip and rectum.

beneath the intestine. The anterior half of this cæcum is a straight narrow tube with thick regular walls and narrow lumen, the posterior portion wider, with irregular walls of

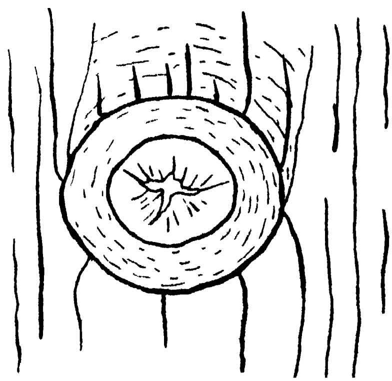
Fig. 5.



Side-view of head, showing asymmetrical ventro-lateral lip, with two unequal papillæ, smaller dorsal lip to the left, and remaining ventro-lateral lip to the right, also œsophagus and nerve-ring.

about the same thickness and a larger lumen, and the surface of the hinder region has a peculiar lobulated appearance. The cæcum is about as wide as the ventriculus at its

Fig. 6.



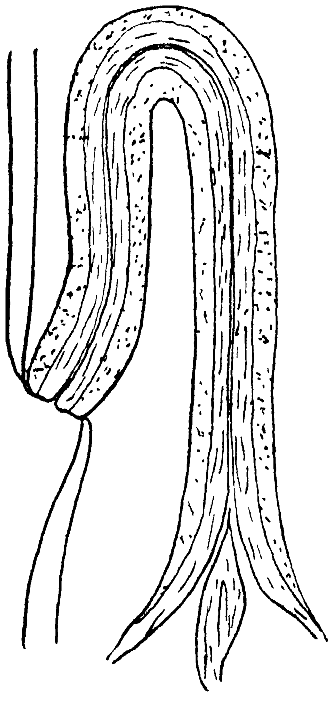
Vulva showing two muscle-layers; vagina behind.

origin, but becomes narrower immediately. The blind end is bluntly rounded. A short anterior cæcum, having a uniform diameter and a rounded end, lying alongside the

œsophagus, arises from the dorsal surface of the intestine at its junction with the ventriculus. It has a thick wall and a very narrow lumen. The nerve-ring is a broad band surrounding the œsophagus near the base of the lips. Close behind it the excretory pore has been located with difficulty.

In the male, which is smaller than the female, the tail is recurved. The spicules are long, thin, unequal, and uniform

Fig. 7.



Vagina showing two muscle-layers and narrow lumen opening into uteri.

in thickness except for the posterior ends, which are pointed. The anus is in a depression with a prominent anterior lip raised above the level of the cuticle, and resembling a transversely extended median papilla, and a posterior lip which just reaches the surface-level. There are three pairs of postanal papillæ : (1) a conical pair immediately lateral and posterior to the anus, (2) a smaller conical lateral pair

Fig. 9

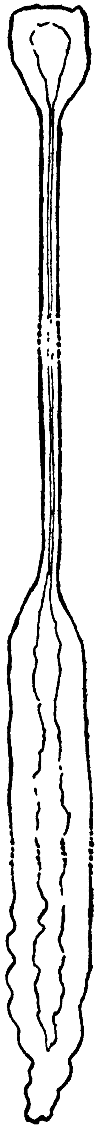


Fig. 8

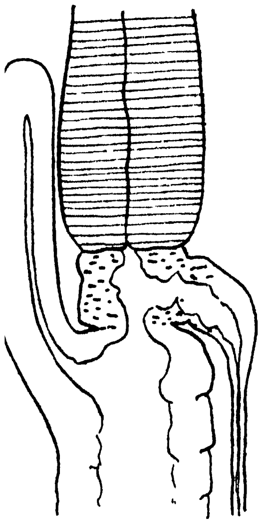


Fig. 8.—Diagram of posterior end of œsophagus, ventriculus, showing origin of posterior cæcum, and intestine with anterior cæcum.
Fig. 9.—Posterior cæcum (shortened) showing difference in anterior and posterior halves.

between the anus and the posterior end, and (3) a very small conical pair, difficult to detect, close to the tip of the tail. The complete series of twelve pairs of preanal papillæ was extremely difficult to detect on all mature males, owing to size and position. The last three pairs are immediately in front of the anus and close together, the spacing increasing rapidly anteriorly. The last four or five pairs are very small flat cones, very near the middle line, the remainder round-headed, more lateral and slightly larger, but more difficult to detect.

In the female the vulva opens in the anterior half of the body, and apparently marks the anterior limit of the extent of the reproductive organs. The vagina, with a thick wall consisting of two distinct muscle-layers (circular and longitudinal) and a narrow lumen, proceeds anteriorly at first, but turns posteriorly to divide into two wide thin-walled uteri. The ovaries and oviducts fill the body-cavity and extend to the end of the intestine. The eggs are large and oval, with smooth thin shells, and a clear space surrounding the granular contents. The anus is a transverse slit with a pronounced anterior lip, but it has not the prominence seen in the male. In the mature specimens the vulva and the vagina can be seen, but no eggs are observable.

The presence of a small ventriculus with a posterior cæcum and of an anteriorly-directed intestinal cæcum places this species in the subfamily Anisakinæ, and further suggests affinities with the genus *Contracæcum*, but the absence of interlabia, characteristic of the latter, makes it difficult to regard it as a member of that genus. Interlabia are absent in some of the known genera of this subfamily, but they differ considerably in other generic characters, particularly in the structure of the alimentary canal. The nearest genus, according to Baylis and Daubney (1926), is *Clæoascaris*, Baylis, 1923, but here each lip has a pair of large conical teeth, and a collar-like fold of cuticle surrounds the neck.

HETEROTYPHLUM, gen. nov.

Generic Diagnosis.—Lips asymmetrical, with two unequal papillæ, without dentigerous ridges. Interlabia absent. Œsophagus with reduced ventriculus giving off a posterior cæcum, of which the posterior half is thicker than the anterior half. An intestinal cæcum present. Spicules unequal. Vulva in anterior half of body.

The work was carried out at Birkbeck College, University of London, and my thanks are due to Dr. H. A. Baylis for the opportunity of examining the material. The type-specimens are in the British Museum (Natural History).

Reference.

Baylis, H. A., and Daubney, R. 1926. 'A Synopsis of the Families and Genera of Nematoda.' Brit. Mus. (Nat. Hist.).

Table of Measurements of Heterotyphlum himantolophi, *sp. n.*

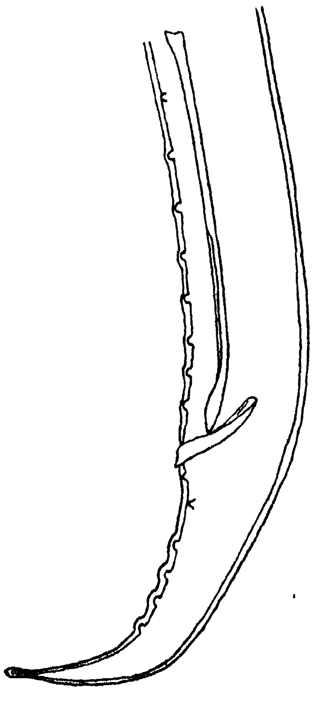
	♀.	♂.
Length	22·6 cm.	15·0 cm.
	mm.	mm.
Width at anterior end	·73	·64
" posterior end	2·6	1·5
" anus	1·0	·7
Length of œsophagus	8·35	8·0
Width of œsophagus (anterior end) (max.)	·60	·56
" " (posterior end) "	·75	·66
" " (minimum)	·49	·43
Length of ventriculus	·50	·4
Width of ventriculus	·70	·6
" intestine	·8	·65
Length of rectum	1·0	·8
" tail	·78	·3
" anterior cæcum	1·2	1·1
Width of anterior cæcum	·45	·4
Length of posterior cæcum	6·0	5–7
Width of posterior cæcum (origin)	·4	·36
" " " (1st part)	·14	·1
" " " (2nd part)	·34	·3
" subcuticular layer	·3	·25
Distance of excretory pore from ant. end.	·32	·36
" nerve-ring from ant. end	·24	·27
Length of lips (ventro-lateral)	·18	·18
Width of lips	·4	·4
Distance of vulva from ant. end	8·4 cm.	..
	mm.	
Length of vagina	7·0	..
Width of vagina	·60–·74	..
Dimension of eggs	80 $\mu \times$ 63 μ	..
Length of spicules (a)	..	3·4
Length of spicules (b)	..	3·2
Width of spicules	..	·024
Œsophagus/length	1/27	1/19
Tail/length	1/290	1/500
Vulva from ant. end/length	1/2·7	..

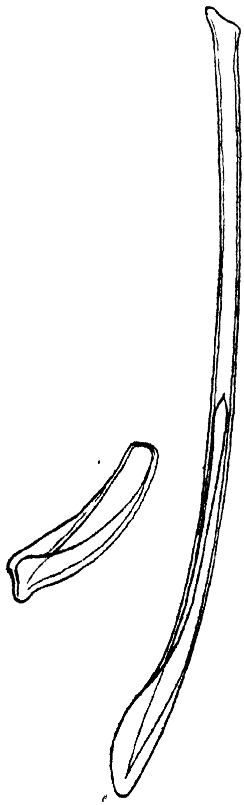
LXXVIII.—*On a new Species of the Nematode Genus* Rhabdochona. By E. A. Spaul, Ph.D., B.Sc., Birkbeck College (University of London).

The examination of some parasitic worms sent by Dr. Hornyold to the British Museum, and obtained from the eel (*Anguilla anguilla*) in Spain, proved them to be a new species of *Rhabdochona.*

Fig. 2.

Fig. 1.





Rhabdochona anguillæ, sp. n.

Fig. 1.—Posterior end of male.
Fig. 2.—Spicules.

Rhabdochona anguillæ, sp. n.

The collection contained four adult females, one of which had the most anterior portion missing, and one adult male. In the table (p. 641) the measurements of the male and the average of those of the females are given. The variations in the female were small.

Fig. 3.

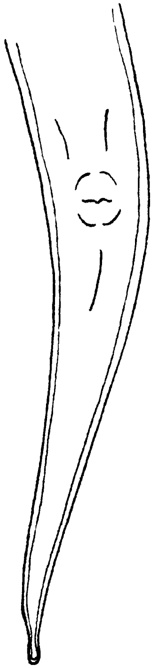
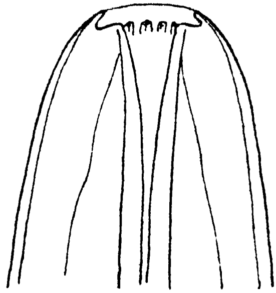


Fig 4.



Rhabdochona anguillæ, sp. n.

Fig. 3.—Posterior end of female.
Fig. 4.—Anterior end.

The body is long and thread-like, uniform in thickness, tapering slightly to the rounded anterior end and posteriorly to form an elongated conical tail terminating in a blunt point. The cuticle is smooth, without distinct striations; subcuticular layer thick and well defined; lateral fields prominent. No cephalic papillæ observed. Head and trunk are

Table comparing Chief Features of Members of the Genus Rhabdochona.

	R. anguillæ, sp. n.		*R. cascadilla*, Wigdor, 1918.		*R. acuminata*, Gendre, 1922.		*R. gambina*, Gendre, 1922.		*R. macrolaima*, Gendre, 1922.		*R. denudata*, Dujardin, 1845.	
Length	♂. 11·4	♀. 20·3 mm.	♂. 3·6	♀. 8·04 mm	♂. 10·5	♀. 18 mm.	♂. 9·36	♀. 20 mm.	♂. Unknown.	♀. 17·86 mm.	♂. 12	♀. 20 mm.
Œsophagus/length	1/3·75	1/6	1/15	..	1/2·6	1/3·7	1/3·3	1/7·5	..	1/3·5	..	..
Tail/length	1/30	1/53	..	1/130	1/23	1/47	1/41	1/71	..	1/70	1/12	1/20
Ant. œsophagus / Post. œsophagus	1/4·6	1/5·2	1/3	1/3	1/10	1/9	1/10·5	1/9	..	1/8	1/2–1/3	..
Vulva from ant. end / Length	..	1/1·8	..	1/1·6	..	1/1·8	..	1/2·1	.	1/1·5	..	Vulva just behind halfway.
Cephalic papillæ	..	.	..	..	2 forked, ·084 fr. end	2 forked ·115 fr. end.	1 simple.	1 simple, ·157 fr. end	..	1 simple, ·065 fr end.	..	..

Caudal papillæ: preanal . .	7 sub., 1 lat.	. .	6, 1 (adanal). . .		11 sub., 1 lat.	. .	10 sub., 1 lat.	. .	. .	. .	8	. .
postanal .	5 sub., 1 lat.	. .	5	. .	5 sub., 1 lat.	. .	4 sub., 1 lat.	. .	. .	. .	5	. .
Buccal cavity and ribs . .	Cavity funnel-shaped, ribs indistinct.		Longitudinal ribs prominent.		Cavity bell-shaped. 14 ribs prominent.		12 ribs prominent throughout length.		Cavity bell-shaped, 12 ribs prominent.		Cavity cup-shaped, chitinous points.	
Length of buccal cavity . .	·042	·042 mm.	. .	. .	·15	·18 mm.	·12	·145 mm.	. .	·21 mm.	. .	. .
Size of eggs	. .	$39\mu \times 25\mu$.	. .	$32\mu \times 16\mu$	. .	$35\mu \times 22\mu$	. .	$40\mu \times 18\mu$	. .	. .	Twice as long as broad.	
Spicules: acutal and relative lengths.	$\frac{1}{4{\cdot}2}\left(\frac{{\cdot}158}{{\cdot}654}\right)$	. .	$\frac{1}{5}\left(\frac{{\cdot}008}{{\cdot}04}\right)$	. .	$\frac{1}{3{\cdot}1}\left(\frac{{\cdot}17}{{\cdot}53}\right)$	. .	$\frac{1}{5{\cdot}7}\left(\frac{{\cdot}083}{{\cdot}47}\right)$	. .	. .	. .	$\frac{1}{2{\cdot}5}\left(\frac{{\cdot}2}{{\cdot}5}\right)$	. .
Striations of cuticle	. .	. .	. .	. .	Indistinct.		Marked.		Indistinct.		Feeble.	

Blank spaces are left where no measurements are recorded.

continuous, with no line of demarcation between them; no definite lips, but a slight lateral prolongation of the body-wall on either side extends forward beyond the anterior limit of the buccal cavity. Dorsally and ventrally the mouth is bounded by cuticle only, and the anterior end is bluntly rounded. The large, open, terminal mouth leads into a funnel-shaped buccal cavity, which gradually decreases in diameter posteriorly and is continuous with the lining of the œsophagus. The longitudinal ribs in the walls of the anterior region of the cavity are not very distinct, but their short anterior projections into the cavity form a prominent ring of chitinoid teeth at the entrance. The œsophagus is long, consisting of a short, faintly transversely striated, anterior portion separated by a faint line of division from a long, non-striated, posterior portion of increased width. The positions of the excretory pore and nerve-ring are difficult to determine.

In the male the conical tail is recurved. The spicules are unequal. One is long and narrow and uniform in thickness except for the posterior end; the posterior half is apparently hollowed out to form a groove, the walls of which expand at the end before terminating sharply. The other spicule is short, grooved, broad, and flat at the anterior end, becoming thick, narrow, and bluntly pointed at the posterior end. The central portion is hollowed out to form a groove whose sides gradually become prominent alæ converging to meet posteriorly and form the thick blunt end. Eight pairs of preanal papillæ, the first pair lateral, all small, rounded, and of approximately the same size, and six pairs of postanal, all small and rounded except the second pair, which is lateral and conical, were observed.

In the female the ovaries and oviducts surround the intestine and are distended with eggs, so that they completely fill the body-cavity in this region. The vulva is in the posterior half of the body. The vagina, after passing backwards a short distance, divides into uteri proceeding in opposite directions. The eggs are oval, clear, smooth, and thin-shelled. In other respects, apart from greater size, the female resembles the male.

The structure of the spicules, the number of caudal papillæ in the male, the buccal cavity, and measurements are the features distinguishing this species from other members of the genus. These differences are emphasized in the accompanying table (pp. 638 & 639).

The work was done at Birkbeck College, University of

London, and I am indebted to Dr. H. A. Baylis for the opportunity of examining the material. The type-specimens are in the British Museum (Natural History).

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Table of Measurements of Rhabdochona anguillæ, sp. n.

	♂.	♀.
	mm.	mm.
Length	11·4	20·3
Width	·225	·29
Dimensions of buccal cavity	·042 × ·016	·042 × ·018
Length of œsophagus (anterior portion)	·54	·54
,, ,, (posterior portion)	2·5	2·8
Total length of œsophagus	3·04	3·34
Width of œsophagus (anterior portion)	·033	·06
,, ,, (posterior portion)	·08	·1
Excretory pore (from anterior end)	....	·24
Nerve-ring (from anterior end)	·15	·16
Position of vulva (from anterior end)	....	11·25
Spicules (*a*)	·654	....
,, (*b*)	·158	....
Dimensions of eggs	....	39 μ × 25 μ
Length of tail	·38	·38
Width of head region	·042	·042
,, anal region	·15	·15
Length of vagina	....	·23
Width of subcuticular layer	·02	·02

LXXIX.—*On* Asterina burtonii, *Gray*. By GEORGE A. SMITH, British Museum (Natural History).

THE purpose of this account is to solve the confusion which has for so long surrounded this species, and to confirm its re-establishment by Verrill (1913) and H. Lyman Clark (1921).

The type of *Asterina burtonii*, Gray, was reported lost by Perrier (1875) and by Bell (1881); but there are two

specimens in the collection of the British Museum, one of which I believe to be the type of Gray's species. These specimens are from the type-locality, are labelled in Gray's own handwriting, and came into his possession a few months before he published his description in 1840. Gray states that his specimens were presented by James Burton, after whom presumably they were named ; the specimens I have discovered, however, are shown by the Museum Register to have been purchased from Stevens. There is no record of any invertebrates being presented by James Burton between the years 1837–1842. It is possible therefore that Gray made a mistake when recording the origin of his specimen. I feel confident that one of these specimens is the type of *Asterina burtonii*—they must at least be regarded as metatypes, since they were determined by Gray himself and came from the original type-locality.

Historical.

Gray established this species in 1840, but two years later Müller and Troschel, in their 'System der Asteriden,' considered it to be identical with *Asteriscus verruculata* (Retzius), 1805 ("Diss. species cognitas asteriarum"). Gray (1847) severely criticised their work, and insisted throughout the rest of his life in maintaining the validity of his species.

Perrier (1875), in his 'Revision of the Stellerides,' does not agree that *burtonii* is a synonym of *verruculata*, but refers it to *Asteriscus cepheus*, Müller and Troschel. This name is from a manuscript of Valenciennes, but the description was first published by Müller and Troschel in 1842, and the name must therefore date from that year. The name *cepheus* subsequently became generally used for this species. Perrier assumed that Valenciennes' manuscript name should be regarded as valid and earlier than Gray's name. This was followed by both Bell (1881) and Sladen (1889).

Verrill (1913) reinstated *Asterina burtonii* as *Asterinides burtonii* 73 years after its original establishment. Fisher (1919) does not follow Verrill's lead, but retains *cepheus* on the ground that Gray's description is insufficient, and that, according to Bell, the type had been lost. Lyman Clark (1921), however, agrees with Verrill in restoring Gray's species to its rightful position. In so doing he says: "The abandoning of Gray's name for this sea-star seems to me quite unjustifiable, even though the type-specimen is lost, for in my judgment the original diagnosis is unmistakable

when considered with the locality given. I do not know of any other *Asterina* of the West Indian Ocean with which there can be any confusion, and I have not the least doubt in my mind as to what *Asterina* Gray had in hand when he described *burtonii*. Under such circumstances I can use no later name, even if it is accompanied by a fuller diagnosis."

Mortensen (1926) also agrees in recognizing Gray's species.

My discovery of two authentic specimens, determined by Gray himself, establishes the fact that he was fully justified in establishing his species, and there can no longer be any reasonable excuse for not using Gray's name, since it has priority over *Asterina cepheus*, M. & Tr.

I therefore propose to designate the five-rayed specimen described below, Museum Register No. 40.3.23.54, as the type-specimen of Gray's species *Asterina burtonii*.

I wish to acknowledge my indebtedness to Mr. C. C. A. Monro for much helpful criticism.

Asterina burtonii, Gray.

Asterina burtonii, Gray, 1840, Ann. & Mag. Nat. Hist. vi. p. 289.
Asteriscus verruculata, Muller and Troschel, 1842, 'System der Asteriden,' p. 41.
Asteriscus verruculatus, Dujardin and Hupé, 1862, Hist. Nat. des Zoophytes, Échinodermes, p. 375.
Asterina gibbosa, von Martens, 1866, Archiv f. Naturg, Bd. i. p. 72.
Asterina burtonii, Gray, 1866, 'Synopsis of the Starfishes of the British Museum,' p. 16; Gray, 1872, Ann. & Mag. Nat. Hist. (4) x. p. 118.
Asterina cephea, Perrier, 1876, Rév. Coll. Stellérides Mus. Hist. Nat. Paris, Arch. Zool. Experimt. v. p. 235.
Asterina cephus, Bell, 1881, Proc. Zool. Soc. Lond. p. 131.
Asterina cephea, de Loriol, 1885, Cat. Raisonné des Échinodermes, recueillis par M. v. de Robillard, à l'Isle Maurice, Mem. Soc. Phys. Hist. Nat. Genève, xxix. No. 4, p. 69.
Asterina cepheus, Sladen, 1889, Asteroidea, H.M.S. 'Challenger,' p. 393.
Asterinides burtonii, Verrill, 1913, Amer. Journ. of Science, (4) xxxv. p. 482.
Asterina cepheus, Fisher, 1919, Bull. U.S. Nat. Mus. c. vol. iii. p. 411, pl. cxv. fig. 4.
Asterina burtonii, H. Lyman Clark, 1921, Dept. of Marine Biology, Carnegie Inst. x. p. 96; H. Lyman Clark, 1923, Ann. S. Afric. Mus. xiii. pt. vii. p. 283.
Asterina burtonii, Mortensen, 1926, Trans. Zool. Soc. Lond. xxii. pt. 1, p. 121.

Gray's diagnosis of his species is as follows:—

"*Asterina burtonii.*—Rays elongate, convex, blunt at end, each of the ossicula of the oral surface with a central group

of three crowded mobile tapering spines, of the dorsal surface with a crowded group of short tubercles. Inhab. Red Sea. James Burton, Esq."

The following is a description of the specimen I have designated the type of the species:—

Rays 5.

R. = 12 mm., r. = 5 mm.

Height of disc 4 mm.

Thickness of ray at base 3 mm.

Locality. Red Sea.

Museum Reg. No. 40.3.23.54.

General form stellate, abactinal surface convex, actinal flat. Rays round and tapering; inter-radial arcs deeply notched. The Madreporite is not visible without cleaning the disc. There are no pedicellariæ. Abactinal plates imbricating; on the disc they are crowded and have the appearance of being forced upward. In the apical area are many small round to oval plates. On the ray the plates are arranged in definite longitudinal series numbering six rows on either side of the median area at the base of the ray, becoming reduced to four at the tip. These plates vary in shape, at the distal end they are round, but proximally quadrangular. In the median area of the ray and on the disc they are occasionally elliptical, with several small round to oval plates in between. The abactinal plates have from four to ten thick tubercles or spines, heavily granulated, slightly serrated, disposed over the whole of the plate. All the spines have been rubbed off the present specimen. Usually the spines would be long, overlapping the papular pores; these pores are small and extend at the base of the ray to the third row of the longitudinal plates.

The ambulacral furrow-spines number five, arranged like a hollowed-out fan; they are blunt and webbed for nearly the whole of their length. The three median spines are longest and equal in length, while the laterals are about two-thirds as long.

On the actinal surface, in the interbrachial area, the plates form regular transverse rows each of seven plates. In addition, parallel with the furrow, and extending to the tip of the ray, are three or four regular longitudinal series of plates. These plates bear two to four mobile spines, which are webbed and arranged in a line across the plate. There are ten teeth to each mouth-angle, the proximal three or four being much the larger. The mouth-plates are deeply excavated, and may bear one and sometimes two spines on their actinal surface. There is considerable granulation

over both the actinal and abactinal surfaces. The inferomarginals form a very evenly arranged series of semicircular plates, and carry as many as ten spines or tubercles in a double series.

The second specimen is very similar to the above, and it is only necessary to briefly state as follows:—

Rays 6.

R. = 8 mm., r. = 5 mm.

Height of disc 3 mm.

Locality. Red Sea.

Museum Reg. No. 40.3.23.55.

Inter-radial arcs not deeply notched, rays thick, hardly tapering. Abactinal plates funnel to star shape over the whole of the ray, having excavations proximally for the papular pores. The Madreporite is not visible.

The discovery of these two specimens, identified by Gray, makes it possible to give a full description of his *Asterina burtonii*, and to identify definitely the particular species he had before him when making his description. The above evidence establishes the fact that Gray's species was a good one and the name takes precedence over *Asterina cepheus*, M. & Tr.

LXXX.—*On a small Collection of Acanthocephala from Rangoon*. By K. Subramanian, B.A., Biology Department, University of Rangoon.

The present paper is based upon an examination of a small collection of Acanthocephala kindly handed over to me by Professor Meggitt. A study of these specimens has revealed the existence of a new species of *Moniliformis* in Burma and the occurrence of *Centrorhynchus pinguis*, Van Cleave, 1918, in a fresh host, *Acridotheres tristis*.

I wish here to express my indebtedness to Professor Meggitt for the loan of his collection of Acanthocephala and also for his assistance at almost every stage of my work.

Mediorhynchus sp.

Host: *Corvus splendens insolens* (intestine).

Locality. Rangoon.

A single female specimen 20·1 * long, maximum diameter

* All measurements in mm.

0·84, diameter anteriorly 0·57, diameter posteriorly 0·54. Lemnisci long, of equal length, slightly coiled. Embryos 0·025 long, 0·012 diameter.

Moniliformis moniliformis (Bremser, 1811).

Host: *Periplaneta americana.*

Locality. Rangoon.

Innumerable specimens of the larvæ were found encysted in the body-cavity of *Periplaneta americana.* The larva is enclosed in an extremely delicate cyst, filled with a white viscous fluid, which probably serves as food for the developing larva. The specimens agreed in all respects with the description of Southwell (1923, pp. 99–101).

The fact that cockroaches in Burma are a common food of rats seems to indicate that *Periplaneta americana* may act as intermediate host.

Moniliformis spiralis, sp. n. (Figs. 1 & 2.)

Host: *Nesokia bengalensis.*

Locality. Rangoon.

A large number of mature and immature forms were collected by Professor Meggitt from the intestine of *Nesokia bengalensis.*

Male.—33–44 long, diameter 0·78. Entire body divided into numerous pseudosegments, the whole worm having the appearance of a Cestode. Proboscis cylindrical. Length 0·36–0·45, diameter 0·12–0·13, a portion of the proboscis being invaginated into the anterior extremity of the worm. Armature 12 longitudinal rows of hooks, approximately 10–13 hooks in each row. Hooks small, 0·017–0·018, inconspicuous, outer end sharply pointed. Proboscis-sheath 0·64–0·81 long, maximum diameter 0·26–0·29; outside wall with parallel thickenings appearing like a coil of ropes. Retractor of proboscis well developed. Lemnisci cylindrical, slightly coiled, slightly unequal in length, 3·71 and 3·05. Testes posterior, close together, one anterior to the other, oval and elongated, sometimes in the principal axis of the body-cavity, sometimes on one side. Anterior and posterior testes approximately the same size, 1·25–1·54 long and 0·29–0·39 in diameter; in one specimen, however, the posterior testis was only a little more than half the size of the anterior. Prostatic glands with 8 clearly distinguishable compact lobes; shape and arrangement showing a considerable degree of variation.

Female.—Body 46 long. Proboscis 0·21–0·26 long, diameter 0·15–0·19; proboscis-sheath 0·57–0·7 long, diameter

0·24–0·26. Body-cavity crowded with embryos. Embryos with three concentric membranes, outer shell slightly wrinkled, approximately twice as long as broad, length varying from 0·084–0·092 and greatest diameter from 0·035–0·046.

Up to the present two species of the genus *Moniliformis* have been described. From the accompanying table (p. 648) it may be seen that the present species is allied to *Moniliformis erinacei*, Southwell and Macfie, 1925, with which it

Fig. 1.

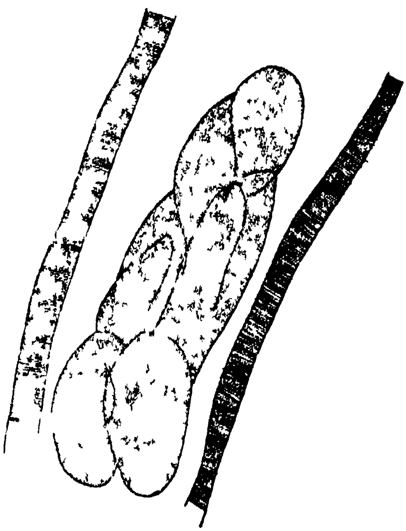
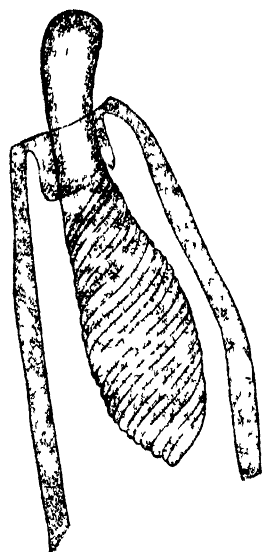


Fig. 2.



Moniliformis spiralis, sp. n.

Fig. 1.—Posterior region, showing the eight individually distinguishable prostatic glands. × 50.

Fig. 2.—Anterior region, showing the characteristic structure of the proboscis-sheath. × about 50.

agrees in the sizes of proboscis, proboscis-sheath, and embryo, but differs in (1) number, arrangement, and size of hooks; (2) peculiar structure of the proboscis-wall; (3) length of lemnisci; (4) size of testis; (5) the eight clearly distinguishable prostatic glands.

These points would appear to be of sufficient importance to justify the creation of a new species, for which the name *Moniliformis spiralis* is proposed.

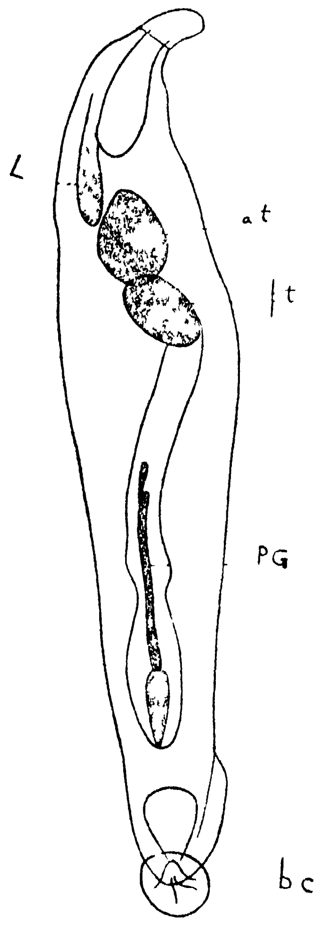
A *Comparative Table of the Species of the Genus* Moniliformis.

Species	*M. spiralis*, sp. n.	*M. moniliformis* (Bremser, 1811).	*M. erinacei*, Southwell & Macfie, 1925.
Proboscis	0·21–0·45 mm. long, diameter 0·12–0·19 mm.	0·5–0·67 mm. long, diameter 0·2 mm.	0·4–0·5 mm. long, maximum diameter 0·2 mm.
Number of antero-posterior rows of hooks.	10–13	12–16	18
Number of hooks in each row	6–7	10–12	7–8
Size of hooks	17–18 μ.	25–30 μ.	30 μ.
Size of proboscis-sheath	0·64–0·81 mm. long, diameter 0·26–0·29 mm.	0·5–1·3 mm. long, greatest breadth 0·22–0·42 mm.	0·8 mm. long, greatest breadth 0·3 mm.
Length of lemnisci	3·71 and 3·05 mm., slightly unequal.	2·4–8·76 mm.	7–8 mm.
Size of testes	0·92–1·54 mm. long, diameter 0·24–0·34 mm.	2–2·5 mm. long, diameter 0·4 mm.	5 mm. long, 1·3 mm. broad.
Prostatic glands	8 compact individually distinguishable bodies.	Single oval mass, individually indistinguishable	Compact mass.
Size of eggs	85–92 μ long, diameter 35–46 μ.	109–137 μ long, greatest breadth 57–63 μ.	92 μ long, diameter 51 μ.
Host	*Nesokia bengalensis.*	*Mus rattus.* *Mus norvegicus.* *Cricetomys gambianus.*	*Erinaceus europæus.*

Centrorhynchus pinguis, Van Cleave, 1918. (Fig. 3.)

Host: common Indian myna (*Acridotheres tristis*) (posterior intestine).

Fig. 3



Male of *Centrorhynchus pinguis*, Van Cleave, 1918. × about 14.

L, lemnisci; *a.t.*, anterior testis; *p.t*, posterior testis; *P.G*, prostatic glands; *b.c*, bursa copulatrix.

Locality. Rangoon.

Van Cleave (1918, pp. 164–167) described only the female

form from the intestine of a magpie, as males could not be found.

Male.—Body "robust, with anterior half slightly inflated." Entire length 8·5; diameter, anterior portion of body 0·71, middle 1·55, posterior 1·29. Proboscis 0·65–0·7 long, diameter 0·35. Proboscis armed with approximately 32 longitudinal rows of hooks, with 16 hooks in each row. Proboscis-hooks of two distinct types—those anterior to insertion of proboscis-receptacle well developed, posterior ones spine-like. Largest and smallest hooks measure 0·041 and 0·030 respectively. Proboscis-receptacle of the type characteristic of the genus, 1·26 long, diameter 0·54. Testes two, oval, lie obliquely one behind the other, placed 0·37 behind posterior end of proboscis-receptacle. Anterior testis 0·91 long, diameter 0·66; posterior testis 0·84 long, diameter 0·52. Prostatic glands 3, two long and tubular, third one small. Prostate-glands commence 1·16 behind posterior testis.

Distribution. China, Burma.

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SOUTHWELL, T. (1923.) "Notes on the Larvæ of *Moniliformis moniliformis* found in African Cockroaches." Journ. Parasitol. ix. pp. 99–101.

SOUTHWELL, T., and MACFIE, J. W. S. (1925.) "On a Collection of Acanthocephala in the Liverpool School of Tropical Medicine." Ann. Trop. Med. Parasitol. vol. xix. pp. 141–184.

VAN CLEAVE, H. J. (1916.) "Acanthocephala of the Genera *Centrorhynchus* and *Mediorhynchus* (New Genus) from North American Birds." Trans. Amer. Microsc. Soc. xxxv. pp. 221–232.

——. (1918.) "*Centrorhynchus pinguis*, n. sp., from China." Journ. Parasitol. iv. pp. 164–167.

LXXXI.—*On a further Collection of Mammals made by Sr. E. Budin in Neuquen, Patagonia.* By OLDFIELD THOMAS.

SEÑOR BUDIN'S work in Neuquen last year having been stopped by the oncoming of the southern winter, an effort was made to enable him to make a second trip to the same region in the summer, and by the generosity of the Misses Godman this has been carried out, and the present paper gives an account of the mammals then obtained.

The number of forms obtained is still small, and the

country has evidently but a poor fauna as compared with similar areas elsewhere. None the less the collection contains many specimens of great interest, including a new subspecies of skunk, a new race of the genus *Reithrodon*, and good series of two forms of the peculiar long-clawed Murines of the genera *Chelemys* and *Geoxus*, forming a valuable addition to our study material of these little-known animals.

The localities visited by Sr. Budin this time were Zapala (1060 m.), where he had worked the previous autumn, San Martin de los Andes, alt. 700 m., in the south-west part of Neuquen territory, about 40° 15′ S. and 71° 20′ W., in the watershed of the Upper Rio Limay, and the Sierra de Pilpil (1200–2000 m.), about 15 km. south of San Martin.

At the last locality he was interested to find the long-clawed *Chelemys* and *Geoxus* living on the permanent snow, under which they made their burrows.

1. *Conepatus suffocans enuchus*, subsp. n.

♀. 2612, 2626. San Martin de los Andes, 705 m.
♂. 2696. Sierra de Pilpil, 1200 m.
[♀. 2419. Chos Malal, 805 m.]

Most nearly allied to *C. s. mendosus*, Thos., but the white striping of the back less reduced, while the tail, equally short, is liberally mixed terminally with long white hairs, its other hairs being broadly white basally, black-ringed terminally. White stripes not coalescing on head, this condition being characteristic of *suffocans* in contrast with *humboldti*. No tendency to a reversed whorl of hairs on the shoulders, as present in *pampanus*. Other characters and skull as usual in *suffocans*.

Dimensions of the type:—

Head and body 260 mm.; tail 172; hind foot 56; ear 21.

Skull: greatest length 67; condylo-basal length 65; zygomatic breadth 42.

Hab. Province of Neuquen. Type from San Martin de los Andes.

Type. Adult female. B.M. no. 27.5.1.1. Original number 2626. Collected 2nd December, 1926. Four specimens.

This skunk is distinguished by various average characters from the other subspecies of *C. suffocans*; from true *suffocans* and *mendosus* by the white hairs on the terminal half of the tail; from *gibsoni* by the reduction of the main white bands, which do not usually reach the tail; and from *pampanus* by

the shorter, less bushy tail and the absence of shoulder-whorls. In distribution it covers the most south-western part of the general area of *C. suffocans*, giving way still further south to the Patagonian skunk, *C. humboldti*. From the little *C. proteus*, to which a specimen of it was doubtfully assigned in the previous paper, it is readily separated by its full normal size.

2. *Rattus norvegicus*, Erxl.

♀. 2693. Sierra de Pilpil, 1200 m.

Sr. Budin found the introduced Norway rat in considerable abundance, living a wild life on the banks of the streams, far away from houses.

3. *Oryzomys longicaudatus*, Benn.

♂. 2570, 2581, 2595; ♀. 2587, 2588, 2635. San Martin de los Andes, 705 m.

♂. 2667; ♀. 2668, 2686. Sierra de Pilpil, 1200–2000 m.

4. *Eligmodontia typus*, F. Cuv.

♂. 2553, 2557. Zapala, 1062 m.

5. *Reithrodon cuniculoides evæ*, subsp. n.

♂. 2559, 2562, 2563; ♀. 2561, 2568, 2569. Zapala, 1062 m.

[♂. 2401. Zapala. *Type*.]

A pale race of *R. cuniculoides*.

General characters of *cuniculoides*, the soles hairy up to the distal foot-pads, which are naked, as is the median basal part of each digit. General colour above pale buffy grey, paler, less buffy, and more greyish than in any other form. Sides pale buffy, often whitish with but little tinge of buffy. Under surface whitish, alone equalled in this respect by *R. caurinus*, the buffy wash pale, and very different from the strong buffy of the other races. Chin and throat whiter; inguinal region white. Ears not so large as in *R. caurinus*.

Skull as usual.

Dimensions of the type:—

Head and body 130 mm.; tail 91; hind foot 32·3; ear 25·6.

Skull: greatest length 34·5; condylo-incisive length 32.

Hab. as above.

Type. Adult male. B.M. no. 26. 10. 11. 38. Original

number 2401. Collected 4th April, 1905, the other specimens collected in October. Seven specimens in all.

This race is decidedly paler than the other forms of *Reithrodon*, the difference well marked at both seasons. One specimen of it (the type) was included in the previous paper without comment, but its pallor was not unobserved; and now that the additional specimens confirm its character, it seems proper to give it a special name. *R. caurinus* alone has so pale an under surface, but is as dark above as in other forms, while the present race is also pale above. And the hairiness of the soles is as in *cuniculoides*, not as in *caurinus*.

Named in honour of Miss Eva Godman, by whose help Sr. Budin was enabled to continue for some months his work in Neuquen.

Sr. Budin did not get *Reithrodon* at Nahuel Huapi, but the specimens from Maiten and Pilcañeu collected by him and Mr. Box are of the usual darker and more intense coloration.

6. *Euneomys micropus alsus*, Thos.

♂. 2577, 2584, 2593, 2598, 2636, 2639; ♀. 2574, 2575, 2596, 2599, 2638. San Martin de los Andes, 705 m.

♂. 2648, 2656, 2676, 2677, 2683, 2684; ♀. 2649, 2674, 2694. Sierra de Pilpil, 1200 m.

Quite like the original series, described from Maiten, Chubut. Since obtained by H. E. Box at Epuyen, Leleque, and Barrancas (near Tecka), Chubut.

7. *Abrothrix suffusus mœrens*, Thos.

15 ♂, 11 ♀. San Martin de los Andes, 705 m.

8 ♂, 1 ♀. Sierra de Pilpil, 1200 m.

Quite like the original set from Nahuel Huapi.

8. *Akodon nucus*, Thos.

♂. 2555, 2560; ♀. 2556, 2566. Zapala, 1062 m.

First discovered in the previous Neuquen collection, specimens being obtained at Chos Malal and Las Lajas.

9. *Akodon beatus*, Thos.

♀. 2564. Zapala, 1062 m.

♂. 2573, 2585, 2586; ♀. 2580, 2623. San Martin de los Andes, 705 m.

♂. 2644, 2653, 2659, 2660, 2675, 2691. Sierra de Pilpil, 1200 m.

10. *Chelemys vestitus fumosus*, subsp. n.

8 ♂, 4 ♀. San Martin de los Andes, 705 m.
8 ♂, 13 ♀. Sierra de Pilpil, 1200–2000 m.

Essentially similar to the southern *C. vestitus*, but the general colour above of a darker and more smoky grey (rather browner than "dark mouse-grey" of Ridgway), the distinctly drabby tone of true *vestitus* almost obsolete, owing to the reduction of the drabby rings on the hairs. Flanks of quite the same colour as the back, not tending to be of a warmer tone, as in *vestitus*. Under surface greyer, less broadly washed with white, and the light of the sides of the neck and belly less strongly contrasted with the dark upper surface. Lateral line of demarcation less defined than in *vestitus* and lower, not passing clear above the forearms, these latter being dark like the back instead of whitish. Hands also, or at least the metacarpals, dark greyish brown instead of white. Tail sharply bicolor, black above, whitish below.

Skull as in *vestitus*. Molars stout and heavy, of the characteristic hypsodont structure of *Chelemys*.

Dimensions of the type:—

Head and body 130 mm.; tail 55; hind foot 24; ear 16·5.

Skull: greatest length 31·5; condylo-incisive length 29·6; zygomatic breadth 16·8; nasals 11·6; interorbital breadth 4·5; breadth of brain-case 14; palatilar length 14; palatal foramina 7·2; upper molar series 5·2.

Hab. as above. Type from the Sierra de Pilpil, 2000 m.

Type. Adult male. B.M. no. 27. 5. 1. 81. Original number 2669. Collected 2nd January, 1927.

This mole-mouse is closely related to *Chelemys macronyx* of San Rafael and *C. vestitus* of southern Patagonia. The former, however, is much paler brown and shorter haired than either of the others, and the new form may best be considered as a darker less drabby subspecies of *vestitus*, specimens from the Leleque and Pilcañeu region of Patagonia being more or less intermediate.

"Found on the high lands up to the limit of snow. Has its runs under the snow."—*E. B.*

A new member of the group recently received may be here described:—

Chelemys angustus, sp. n.

General external appearance, as far as remembered by the collector, very much as in *C. vestitus* or *Geoxus fossor*.

Skull in general shape rather like that of *Geoxus fossor*,

although rather more robust, with stouter muzzle and more vertical front edge of the zygoma-root; the supraorbital edges more squared, and the brain-case not so smoothly rounded and papery. Compared with that of *Ch. vestitus* it is far smaller and more slenderly built. Palatal foramina long, well open, with rounded edges, reaching nearly to the level of the middle of m^1.

Incisors fairly thick and robust, their general proportion to the skull as in *Chelemys*, as contrasted with the very slender incisors of *Geoxus*. Molars of normal proportional size, not reduced as in *Geoxus*, more or less hypsodont, as in *Chelemys*, though neither so large nor so complicated as in *C. vestitus*. But neither are they so narrow, contracted, and brachyodont as in *Geoxus*.

Dimensions of the typical skull:—

Greatest length 27 mm.; condylo-incisive length 24; zygomatic breadth 13·5; nasals 10·6 × 3·2;; interorbital breadth 5·1; breadth of brain-case 12·4; zygomatic plate 1·9; palatilar length 10·2; palatal foramina 6; upper molar series 3·9; breadth of m^1 1·2.

Hab. Bariloche, E. of Lake Nahuel Huapi. Alt. 800 m.

Type. Adult skull. B.M. no. 27. 2. 16. 1. Collected and presented by F. W. Edwards, Esq. Specimen picked up dead, Oct. 30, 1926, in the desert-country to the east of Bariloche.

Apparently allied only to the species called *Notiomys connectens* by Osgood, from Cautin Province on the western side of the Andes, but that is larger, with markedly longer snout, nasals, and palatine foramina. I assume that the skull-length given—39·8 mm.—is a misprint for 29·8.

During a recent entomological excursion into Patagonia my colleague Mr. F. W. Edwards picked up near Bariloche the decayed carcase of a mouse, of which he was only able to preserve the head. No doubt its external characters are those found in other allied species of the group, but the skull-characters are distinctive, so far as its relations to known species are concerned, for, with the exception of *C. connectens*, none of the typical *Chelemys* have anything like so small and narrow a skull, nor have the small narrow-headed forms of *Geoxus* such large teeth, and it evidently represents a new species, and one of a very interesting nature.

For I have naturally been much interested in Mr. Osgood's paper on "The Long-clawed South-American Rodents of the Genus *Notiomys*" *, in which he comes to the conclusion

* Field Museum of Natural History. Publication 229, Zoological Series, xii. no. 9 (1925).

that all the three groups *Notiomys*, *Chelemys*, and *Geoxus* only form a single genus—mainly characterized by the external characters of long claws, short tail, and fossorial habits,—and that the division into three on the skull and dentition is not justified.

This, however, I am not prepared to admit. In the first place, *Notiomys* itself, as based on the type, now happily become by exchange a part of the British Museum Collection*, is readily distinguishable by the peculiar short dumpy shape of the skull, quite unlike that of any other member of the group. Its broad muzzle and interorbital region, squared supraorbital edges, widely splayed anteorbital foramina, narrow, vertical, non-projecting zygomatic plate, short palatal foramina, and minute brachyodont molars make up an *ensemble* to which one cannot do otherwise than give generic rank. Mr. Osgood had not seen a specimen of this animal, nor does the figure of the skull, published in Paris in 1890, give any proper idea of its characters.

But the case of *Geoxus* v. *Chelemys* is more difficult, and in view of the considerable range of variation in the skull and teeth, it is possible that future workers will come to Mr. Osgood's opinion. And I frankly admit that the new species now described—*Chelemys angustus*—is more or less annectant, agreeing with *Chelemys* in its teeth, but with very much the skull-shape of *Geoxus*. And it was no doubt the study of the allied and equally annectant *C. connectens* which brought Mr. Osgood to his joining-up opinion.

For the moment, however, I still believe, without wishing to be dogmatic on the subject, that there really are two natural groups—the one, *Chelemys*, with larger, more complicated, hypsodont teeth, the skull generally robust and broadly built, with broad vertical frontal zygomatic plate and solid brain-case; and the other, *Geoxus*, with small, simple, brachyodont teeth, the skull slender, delicate, with narrow muzzle, narrow slanting zygomatic plate, and papery brain-case. But within each, the tooth-characters being taken as primary, a range of skull-structure should be allowed for which would bring *angustus* into *Chelemys*.

We must leave it to time to clear the problem up, and this will only be done when young specimens, now conspicuous by their nearly complete absence, are available for a proper study of the dental characters of all three groups.

11. *Geoxus fossor*, Thos.

♂. 2572, 2594, 2606, 2632, 2633; ♀. 2617, 2624, 2627, 2631. San Martin de los Andes, 705 m.

* B.M. no. 18. 12. 21. 1.

♂. 2687; ♀. 2673, 2688, 2692. Sierra de Pilpil, 1200–1500 m.

A valuable series, and very helpful towards the study of the *Chelemys-Geoxus* problem, even though, unfortunately, there are no really young specimens included in it.

12. *Ctenomys mendocinus maulinus*, Phil.

♂. 2549, 2550, 2552; ♀. 2548, 2551. Zapala, 1062 m.

These specimens, killed in early summer, are exactly similar to those obtained at the same place in early winter last year, no change that can be ascribed to season being perceptible. In a general way the more northern specimens from Mendoza and Tupungato, representing typical *mendocinus*, are a warmer drab than those from Chos Malal, where they are generally of a more smoky grey, this representing Philippi's *maulinus*. Those from Zapala are a slightly paler fawn.

13. *Lagidium saræ*, Thos.

♀. 2622. E. of San Martin de los Andes, 700 m.

An additional specimen of this fine vizcacha, named in honour of Mrs. Spedan Lewis, is a most acceptable addition to the collection.

14. *Galea negrensis*, Thos.

♀. 2558. Zapala, 1062 m.

15. *Caviella australis nigriana*, Thos.

♂. 2554, 2565, 2567. Zapala, 1062 m.

The majority of the recent Budin specimens have the skull rather smaller, with narrower, more parallel-sided muzzle, and smaller bullæ than the original type from Neuquen. But no. 2537, from Las Lajas, so closely corresponds with the type in these respects as to dissipate any suspicion that two different subspecies were involved, as at one time I thought might be the case.

16. *Marmosa elegans pallidior*, Thos.

2 ♀ in al. Zapala.

These specimens are of particular value as giving an opportunity to count the mammæ, which form a character of undoubted value, but, owing to the great difficulty of distinguishing them, can seldom be enumerated with certainty.

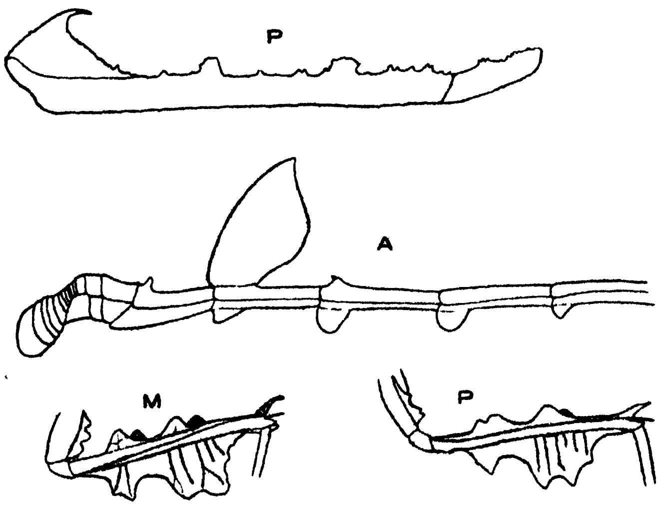
One of these specimens has clearly the large number of 9—1—9=19, the other being apparently the same.

Counts on skins are very rarely reliable, while even on spirit-specimens there is commonly great difficulty in being sure of the exact number present.

LXXXII.—*A new Mantid from Burma.* By B. P. Uvarov.

Paratoxodera meggitti, sp. n.

♂. Head triangular, concave in front. Ocelli large, placed on a raised tubercle and forming a triangle. Eyes strongly projecting sideways and also somewhat forwards, each with a stout conical terminal spine directed slightly forward.



Paratoxodera meggitti, sp. n.

P, pronotum in profile; A, end of abdomen in profile; M, median, and P, posterior leg viewed from below.

Pronotum long, slender, strongly laterally compressed in metazona, which is straight in profile and forms a very obtuse angle with the feebly ascending prozona. Margins denticulate, more densely so in metazona, where there are dense minute denticulations between the larger and evenly spaced ones. Sloping sides of the metazona bearing irregularly

scattered small tubercles. Prozona with two groups of obtuse tubercles near the median line, which is not raised, while in the metazona it is sharply raised and bearing numerous tubercles, as well as two tuberculate lobes, and, at the posterior end, a foliaceous triangular appendage with strongly pointed apex directed forwards.

Abdomen below with fairly large, short, rounded-triangular lobes at the apex of each sternite. Third tergite with a small lobiform fold at the apex; fourth tergite with a large foliaceous appendage, which is higher than the tergite is long and directed obliquely forwards, with the front margin rounded-excised near the base, sinuate in the rest, hind margin broadly rounded and the apex somewhat attenuate; the appendage is split into two sheets behind; fifth tergite at the hind margin with a small lobe bent forward. Cerci foliaceous, obliquely pear-shaped.

Front coxæ shorter than half of the metazona, all margins with minute tubercles and spinules. Front femora slender, slightly curved; median apical lobe triangular; upper genicular lobes armed with two distinct spines, lower ones with one very short spinule; seven regularly spaced even-sized outer spines; inner margin with fifteen spines of alternating size, the last (pre-apical) spine being widely separated from the preceding one; margins between spines densely and minutely spinulose. Front tibiæ shorter than femora; outer spines twelve in number, varying in length as follows (beginning from the base):—ɪɪɪIɪɪIɪɪɪɪI; inner spines twenty-two in number, varying in length as follows:—IɪIɪIɪɪIɪɪIɪɪɪIɪɪɪɪIɪI; all spines slightly curved, the larger ones somewhat inflated basally.

Middle and hind coxæ with tridentate foliaceous lobes. Middle and hind femora with eroded foliaceous lobes on all margins; each knee with three acutangular lobes and a fine filament-like spine between them. Middle and hind tibiæ very slender; upper spur of each tibia large, flattened.

Elytra reaching the middle of the fourth tergite.

General coloration reddish brown, irregularly mottled with brown, the general scheme being that of dead leaves. Elytra hyaline, infumate laterally, and with a few brownish streaks along the principal veins.

Total length 78 mm.; pronotum 30; elytra 34; front coxa 12; front femur 14; front tibia 10; hind femur 12; hind tibia 12·5.

Described from a single male, sent from Burma by Prof. F. J. Meggitt. Type in the British Museum.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

January 5th, 1927.—Dr. F. A. Bather, M.A., F.R.S., President, in the Chair.

The following communication was read :—

'The Tertiary and Post-Tertiary Lacustrine Sediments of the Nyasan Rift-Valley.' By Frank Dixey, D.Sc., F.G.S. (Read by Dr. John Parkinson, M.A., F.G.S.)

The series of lacustrine sediments extending along the north-western shores of Lake Nyasa, formerly thought to be of recent age, are now known to include the Deinosaur-Beds of late Jurassic or early Cretaceous age, as well as the following six groups of beds that range through Tertiary and post-Tertiary times :—

(6) Recent deposits.	Recent.
(5) The Dwangwa Gravels.	
(4) The Songwe Volcanic Rocks.	Pleistocene.
(3) The Chitimwe Beds.	
(2) The Chiwondo Beds.	Pliocene.
(1) The Sungwa Beds.	? Miocene.

These sediments extend over an area 78 miles in length and 12 miles in maximum width, and they occupy the floors of several minor rifts that run parallel with the main rift-valley. The beds extend increasingly farther inland according to their age, and the oldest group (the Sungwa Beds) rises to a height of 1000 feet above the present level of the lake. The different groups rest upon the worn edges of the Deinosaur-Beds and all older rocks, and they are themselves separated by a series of unconformities; moreover, the sediments all dip towards the floor of the main rift, and each group is inclined in this direction at a steeper angle than that of the group immediately overlying it. These observations are of considerable interest in connexion with the structure of the main rift-valley, as well as with the development of Lake Nyasa itself.

The Sungwa Beds consist of thickly bedded sandstones and conglomerates, of which only a few small patches remain.

The Chiwondo Beds comprise a thick series of calcareous sands, marls, and limestones; they have yielded remains of *Mastodon* and of *Hippopotamus*, as well as a number of associated fossil shells.

The Chitimwe Beds consist of red conglomerates and gravels that usually form a strong battlemented capping to the outcrops of the Chiwondo Beds.

The Songwe Volcanic Rocks comprise variable tuffs and ashes; they occur only at the northern end of the lake.

The Dwangwa Gravels may be traced almost all around the lake at a maximum height of 400 feet.

The recent deposits include the youngest lacustrine sediments, up to a height of about 160 feet above lake-level.

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END OF THE NINETEENTH VOLUME.

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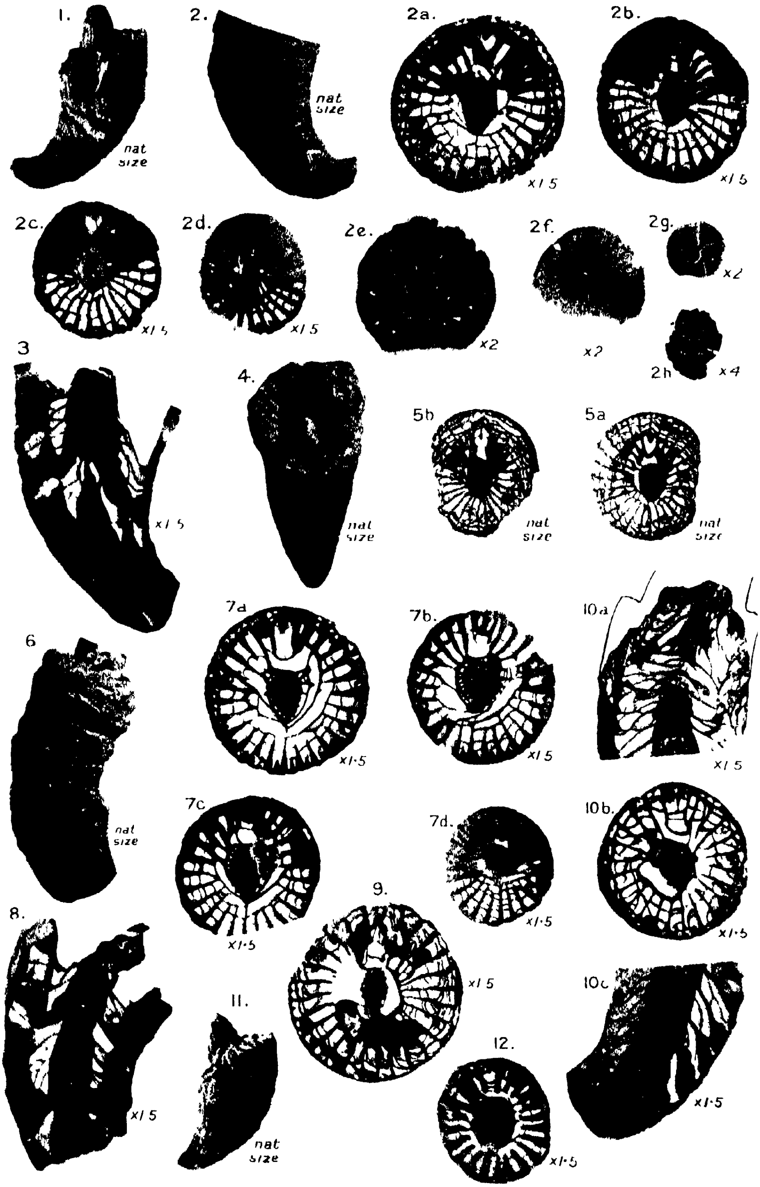

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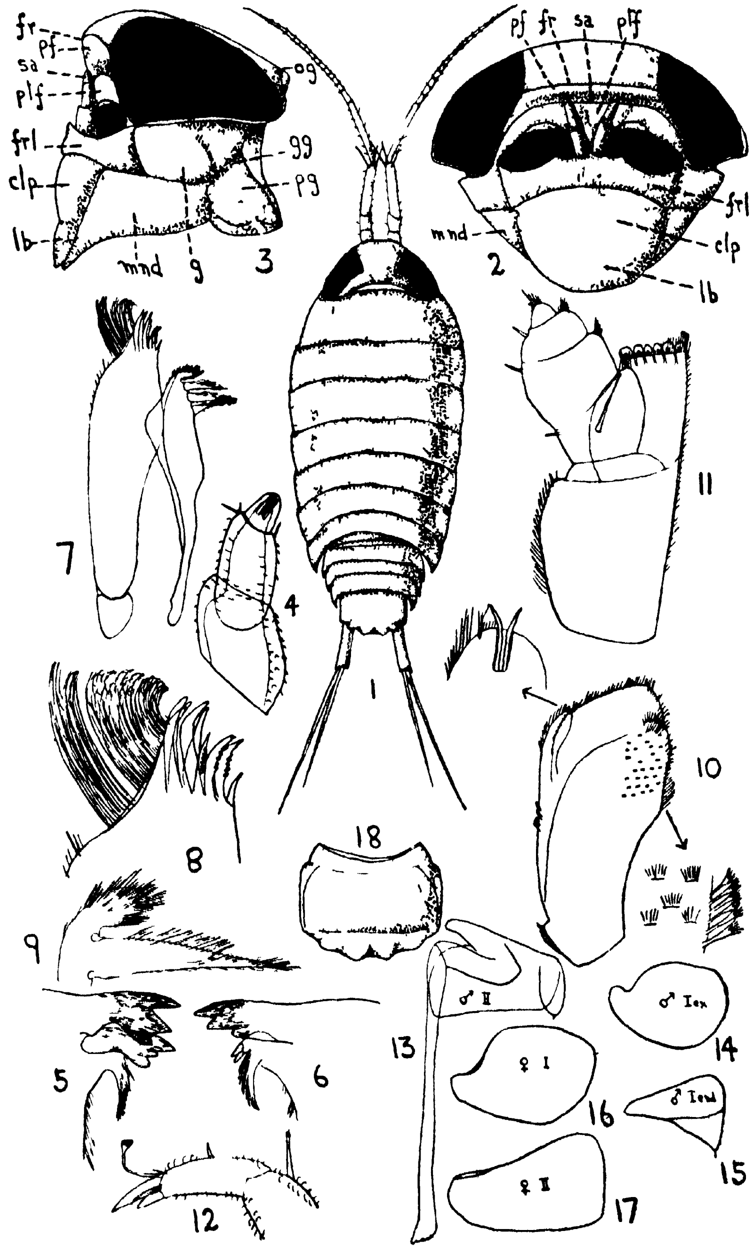
RYLSTONIA BENECOMPACTA, gen. et sp nov., AND VARIANTS.



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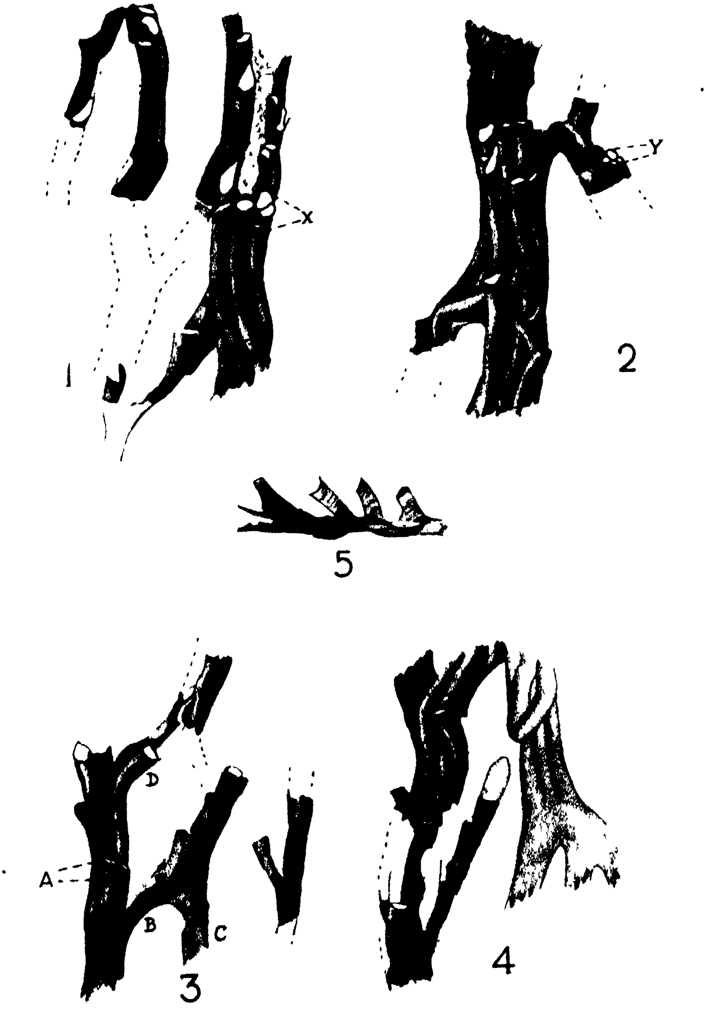
Pogonoligia muscorum.

Viviparus coxi, sp. n.



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KOREMAGRAPTUS ONNIENSIS.

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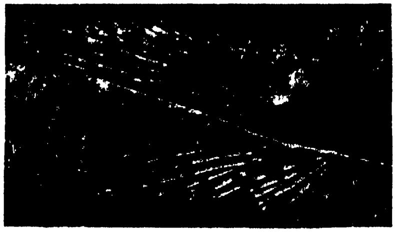

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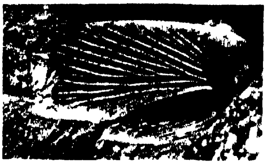

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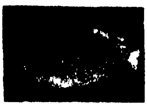

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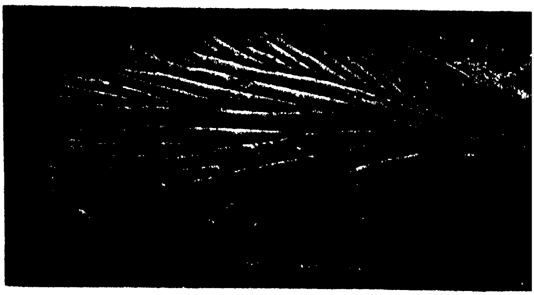

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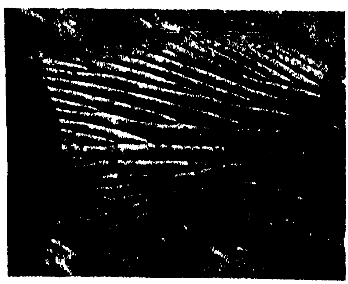

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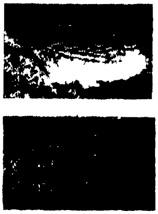
CARBONIFEROUS INSECTS FROM MARYLAND



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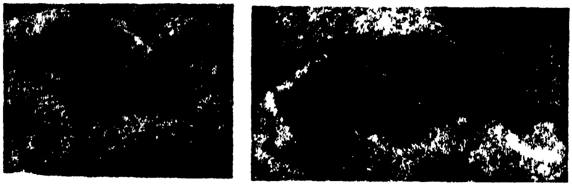

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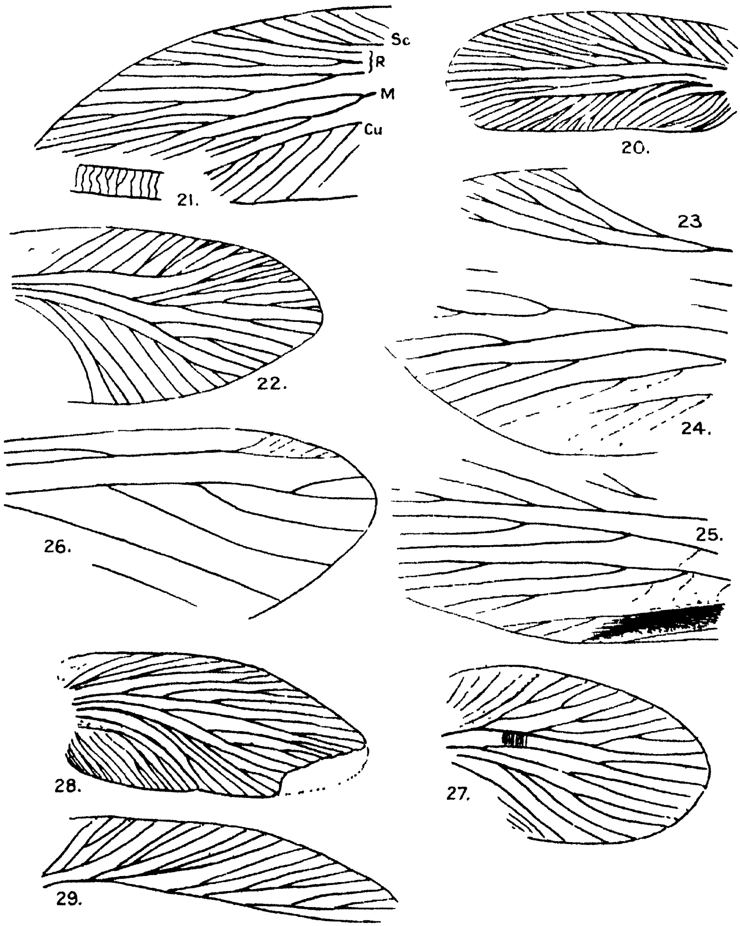

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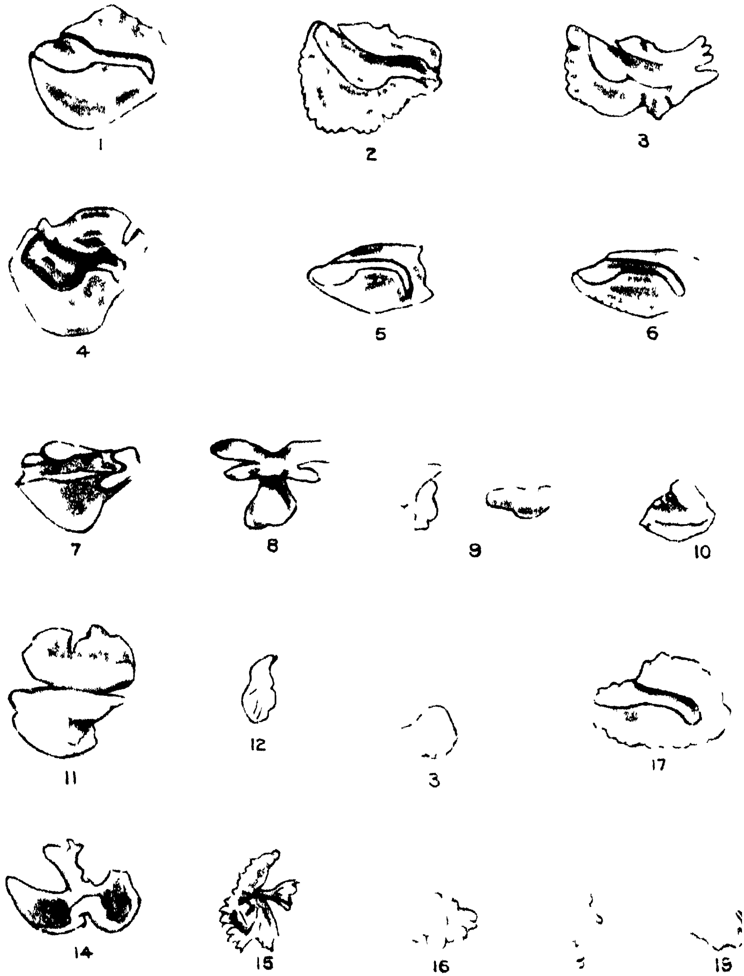

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OTOLITHS OF THE ORDERS
ALLOTRIOGNATHI, BERYCOMORPHI, ZEOMORPHI

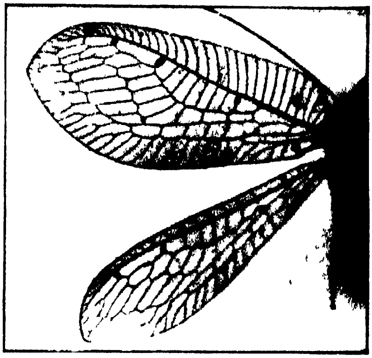
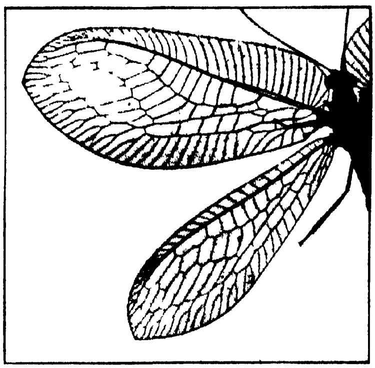


FIG. 1.



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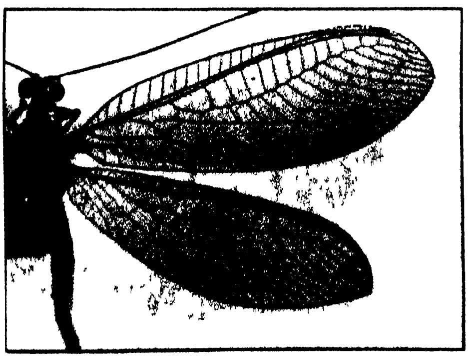
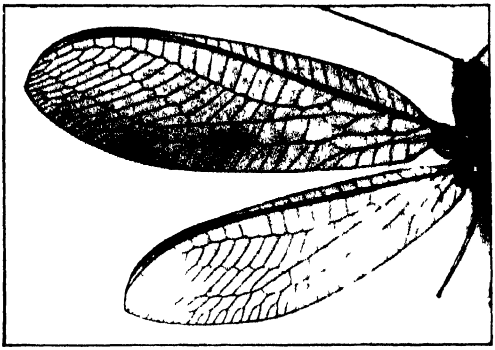


FIG. 3.

Chrysopidæ from the Seychelles and adjacent Islands.



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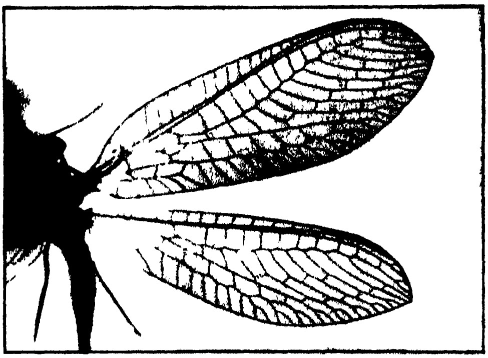

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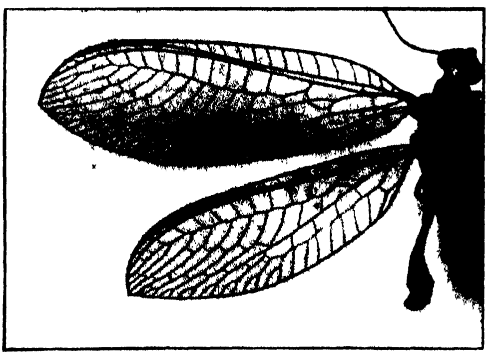
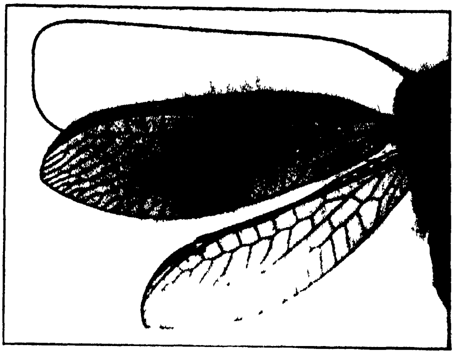


FIG. 6.

Chrysopidæ from the Seychelles and adjacent Islands.



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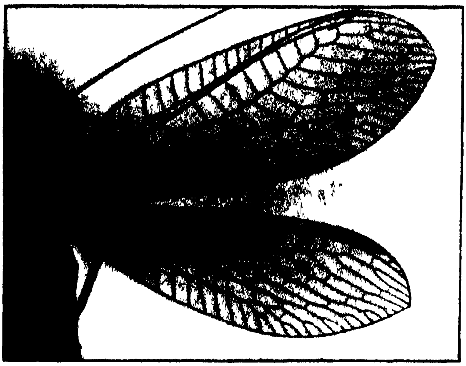

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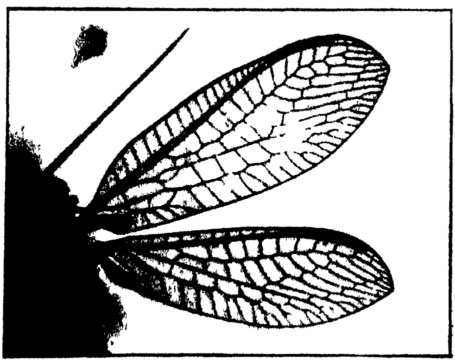
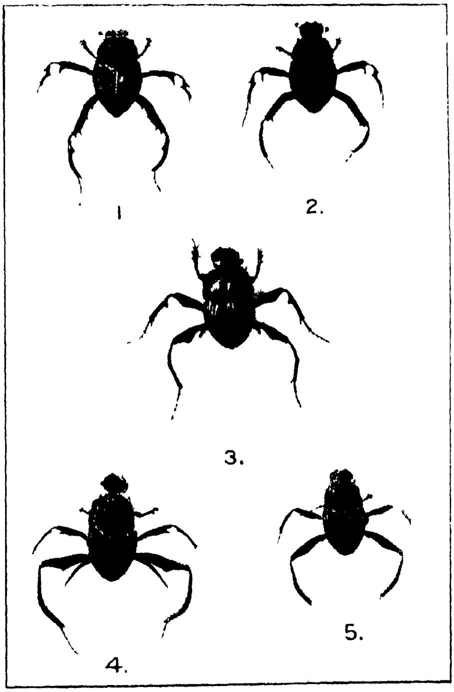
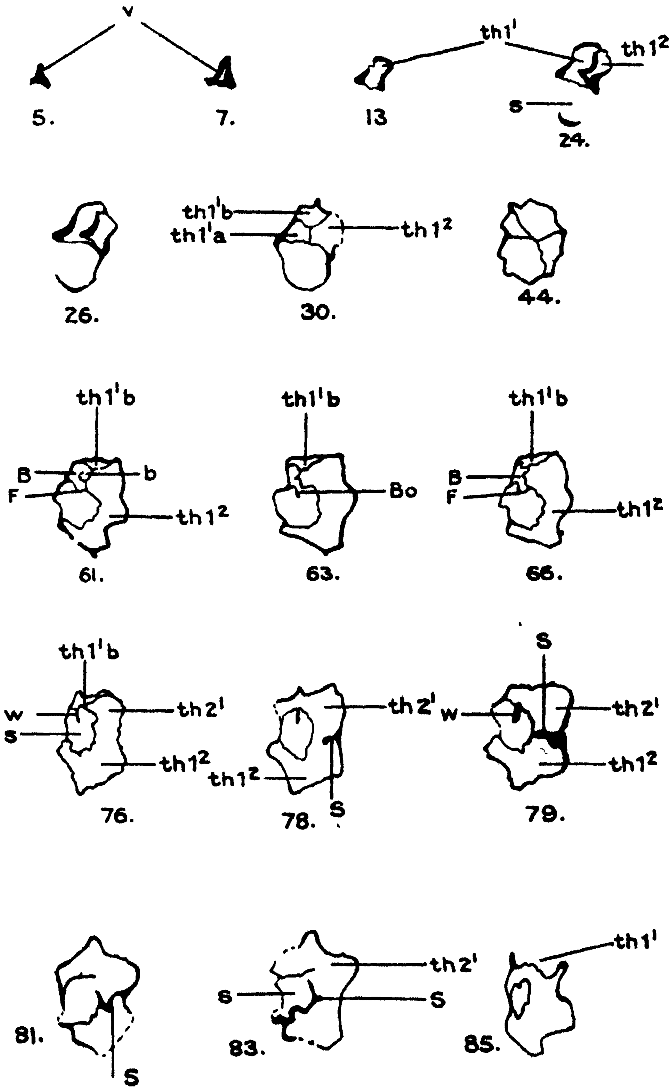


FIG. 9.

Chrysopidæ from the Seychelles and adjacent Islands.



Beetles of the Genus Sisyphus (Scarabæidæ). Natural size.



GLYPTOGRAPTUS AFF. TAMARISCUS (NICHOLSON).

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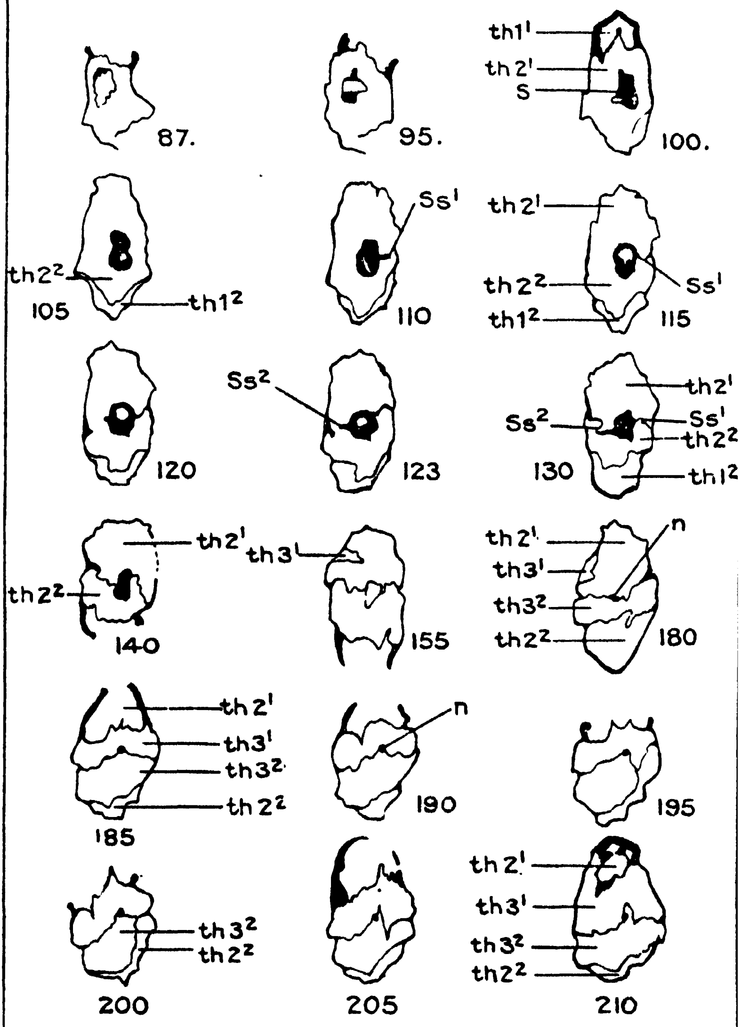

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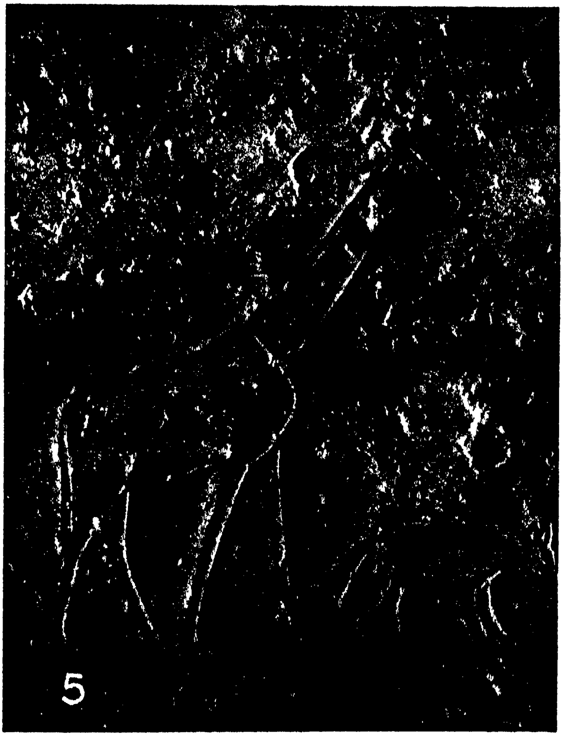

Giraffe from a Middle Kingdom Tomb at Meir, Egypt.